DISSERTATION ON

THROMBOLYSIS IN STEMI- ASSESSMENT OF EFFICACY OF STREPTOKINASE WITH RESPECT TO ST-SEGMENT RESOLUTION IN RELATION TO TIME INTERVAL

Dissertation submitted to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

In partial fulfillment of the regulations
for the award of the degree of

M.D. IN GENERAL MEDICINE

BRANCH – I

THANJAVUR MEDICAL COLLEGE,

THANJAVUR - 613 004

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI - 600 032

APRIL -2015

CERTIFICATE

This is to certify that this dissertation entitled "**THROMBOLYSIS IN STEMI- ASSESSMENT OF EFFICACY OF STREPTOKINASE WITH RESPECT TO ST-SEGMENT RESOLUTION IN RELATION TO TIME INTERVAL"** is the bonafide original work of **Dr.KARTHIK.S** in partial fulfillment of the requirements for M.D. Branch – I (General Medicine) Examination of the Tamilnadu Dr.M.G.R. Medical University to be held in APRIL - 2015. The period of the study was from December 2013 to August 2014.

Prof.Dr.P.G.SANKARANARAYANAN,M.D.,
UNIT CHIEF M-I,
DEPT. OF INTERNAL MEDICINE,
THANJAVUR MEDICAL COLLEGE,
THANJAVUR - 613 004.

Prof.Dr.P.G.SANKARANARAYANAN,M.D.,
HEAD OF THE DEPARTMENT,
DEPT. OF INTERNAL MEDICINE,
THANJAVUR MEDICAL COLLEGE,
THANJAVUR – 613004.

Prof.Dr.P.G.SANKARANARAYANAN,M.D.,
DEAN I/C,
THANJAVUR MEDICAL COLLEGE,
THANJAVUR – 613 004.

DECLARATION

I, **Dr.KARTHIK.S** solemnly declare that dissertation titled "**THROMBOLYSIS IN STEMI-ASSESSMENT OF EFFICACY OF STREPTOKINASE WITH RESPECT TO ST-SEGMENT RESOLUTION IN RELATION TO TIME INTERVAL"** is a bonafide work done by me at Thanjavur Medical College and Hospital, Thanjavur during December 2013 to August 2014 under the guidance and supervision of **Prof. Dr.P.G.SANKARANARAYANAN, M.D.,** Unit Chief M-I and Head of the Department, Department of Internal Medicine, Thanjavur Medical College and Hospital, Thanjavur.

This dissertation is submitted to Tamilnadu Dr.M.G.R. Medical University towards partial fulfillment of requirement for the award of **M.D. Degree (Branch – I) in General Medicine.**

Place: Thanjavur

Date:

(Dr. KARTHIK.S)

Postgraduate Student,
M.D. in General Medicine,
Thanjavur Medical College,
Thanjavur - 613 004

ACKNOWLEDGEMENT

I am extremely thankful to **Prof.Dr.P.G.SANKARANARAYANAN, MD.,** Dean I/C, my unit chief, Professor and Head of the Department of Medicine, Thanjavur Medical College and Hospital for allowing me to do this dissertation and utilize the institutional facilities. I also thank him for his full fledged support, constant encouragement , valuable suggestions and timely guidance during my study and my post graduate period. I am greatly indebted to my Professor.

I profoundly thank my respected professors

Prof.Dr.K.Nagarajan, M.D., Prof.Dr.S.Manoharan M.D.,

Prof.Dr.C.Ganesan, M.D., and Prof.Dr.D.Nehru, M.D., for their advice and valuable criticisms which enabled me to do this work effectively. I would also like to express my gratitude to the former Head of the Department of Medicine **Prof Dr.S.Muthukumaran M.D.,** for his support and encouragement.

I extend my sincere gratitude to **Dr.A.Gunasekaran M.D., DM (Neuro).,** Registrar , Department of Medicine for his support and guidance.

I am grateful to **Prof.Dr.SENTHIL KUMAR.,** Professor and Head of the Dept of CARDIOLOGY, Thanjavur Medical College and Hospital for permitting me to use the facilities of the Department and for his valuable guidance and encouragement.

I am extremely thankful to my Assistant Professors **Dr.A.Gunasekaran M.D., DM (Neuro)., and Dr. C.Sundararajan, M.D.,** for their guidance, motivation, support and encouragement.

I would also like to thank my Assistant Professors **Dr.C.Paranthakan, M.D., Dr.A.Magesh M.D., Dr. Vinoth MD., and Dr.Muthukumaran M.D.,** for their guidance and support.

I express my gratitude to **Dr.G.KANNAPPAN**, **M.D.D.M (cardio).,** **Dr**.**SRINIVASAN M.D, D.M (Cardio).,** **Dr.CHAKKARAVARTHI**, **M.D.D.M (cardio).,**Assistant Professors of cardiology , Thanjavur Medical College and Hospital for their guidance and encouragement.

I am also thankful to my colleagues for their full cooperation in this study.

I extend my thanks to all staff members, ECG technicians who helped me during this study period.

I would like to express my sincere gratitude to my family members who have constantly supported me in pursuing my study.

My sincere thanks to all the patients who co-operated for this study, without whom this study would not have been possible.

Thanjavur Medical College

THANJAVUR, TAMILNADU, INDIA-613 001

(Affiliated to the T.N.Dr.MGR Medical University, Chennai)

INSTITUTIONAL ETHICAL COMMITTEE

CERTIFICATE

Approval No. : 071

This is to certify that The Research Proposal / Project titled

THROMBOLYSIS IN STEMI - ASSESSMENT OF EFFICACY OF STREPTOKINASE WITH RESPECT TO ST SEGMENT RESOLUTION - IN RELATION TO TIME INTERVAL

submitted by Dr. S. KARTHIK **of**

Dept. of GENERAL MEDICINE **Thanjavur Medical College, Thanjavur**

was approved by the Ethical Committee.

Thanjavur

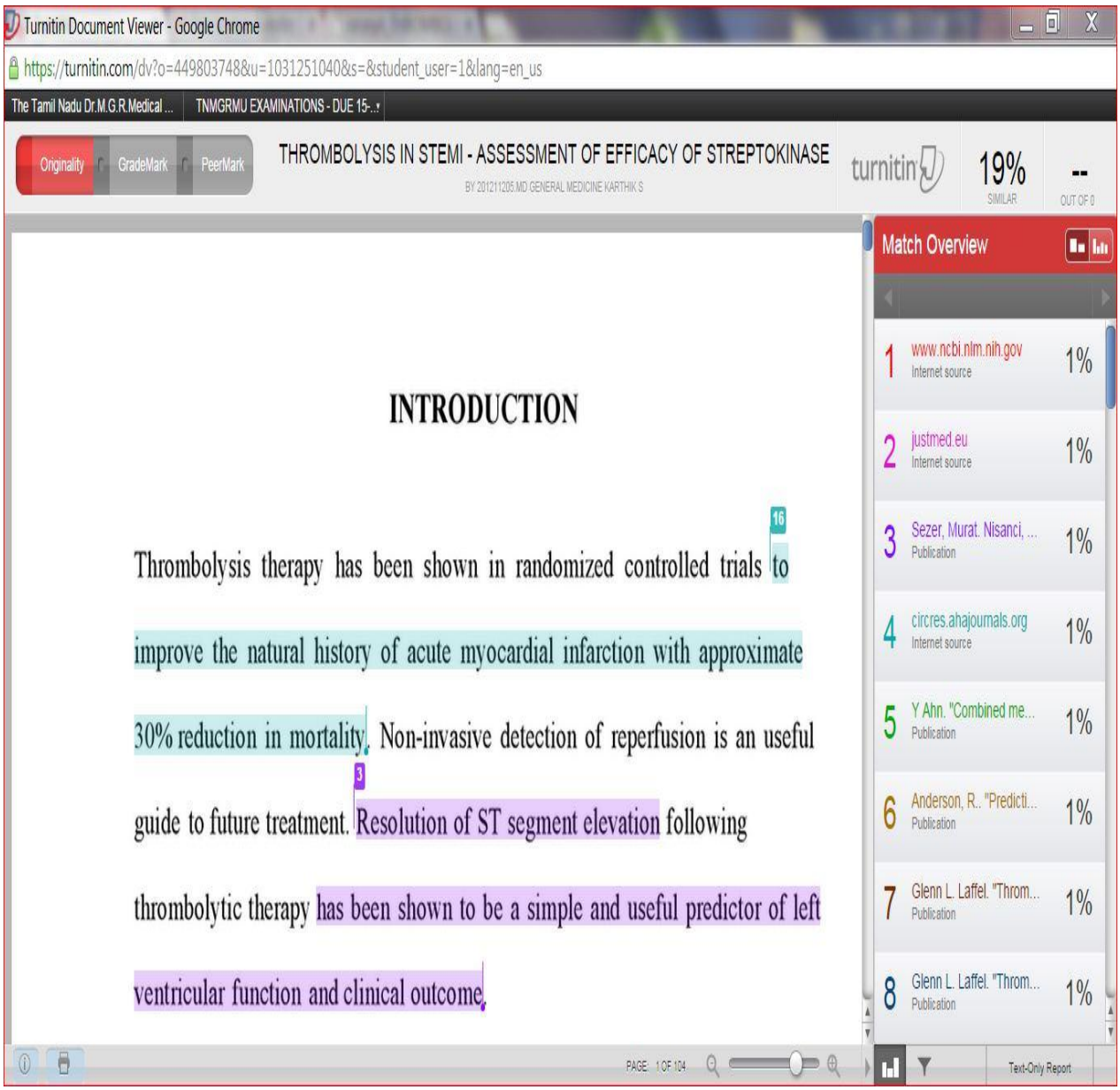
Dated :

THANJAVUR MEDICAL COLLEGE * THANJAVUR-4 *

Secretary

Ethical Committee

TMC, Thanjavur.


Turnitin Document Viewer - Google Chrome
https://turnitin.com/dv?o=449803748&u=1031251040&s=&student_user=1&lang=en_us
The Tamil Nadu Dr.M.G.R.Medical ...
TNMGRMU EXAMINATIONS - DUE 15-..
Originality
GradeMark
PeerMark
THROMBOLYSIS IN STEMI - ASSESSMENT OF EFFICACY OF STREPTOKINASE
BY 20121205.MD GENERAL MEDICINE KARTHIK S
turnitin
19%
SIMILAR
--
OUT OF 0
INTRODUCTION
Thrombolysis therapy has been shown in randomized controlled trials to improve the natural history of acute myocardial infarction with approximate 30% reduction in mortality. Non-invasive detection of reperfusion is an useful guide to future treatment. Resolution of ST segment elevation following thrombolytic therapy has been shown to be a simple and useful predictor of left ventricular function and clinical outcome.
Match Overview
1 www.ncbi.nlm.nih.gov Internet source 1%
2 justmed.eu Internet source 1%
3 Sezer, Murat. Nisanci, ... Publication 1%
4 circres.ahajournals.org Internet source 1%
5 Y Ahn. "Combined me... Publication 1%
6 Anderson, R.. "Predicti... Publication 1%
7 Glenn L. Laffel. "Throm... Publication 1%
8 Glenn L. Laffel. "Throm... Publication 1%
PAGE: 1 OF 104
Text-Only Report

turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	201211205.md General Medicine KA...
Assignment title:	TNMGRMU EXAMINATIONS
Submission title:	THROMBOLYSIS IN STEMI - ASSE...
File name:	0002dissertation.docx
File size:	2.03M
Page count:	104
Word count:	11,285
Character count:	63,171
Submission date:	21-Sep-2014 10:55PM
Submission ID:	449803748

INTRODUCTION

Thrombolysis therapy has been shown in randomized controlled trials to improve the natural history of acute myocardial infarction with approximate 50% reduction in mortality. Non-invasive detection of reperfusion is an useful guide to future treatment. Resolution of ST segment elevation following thrombolytic therapy has been shown to be a simple and useful predictor of left ventricular function and clinical outcome.

The study is an effort to study the patients with acute myocardial infarction comparing their ECG findings on admission and subsequently after thrombolysis. And the outcome of thrombolysis therapy in terms of mortality and morbidity during hospital stay.

Acute myocardial infarction is a major scourge of our times. It assumes increasing importance as it affects people in the most productive period of their life.

The mortality and morbidity caused by acute myocardial infarction are major public health concern in the industrialized world and also slowly becoming a leading cause of mortality in developing countries as infectious diseases begin

LIST OF ABBREVIATIONS

ACC	American College of Cardiology
AHA	American Heart Association
AIVR	Accelerated Idioventricular rhythm
AMI	Acute myocardial infarction
APSAC	Anisoylated plasminogen streptokinase activator complex
ATP	Adenosine triphosphate
AV node	Atrio ventricular node
AVM	Arterio venous malformation
CK	Creatinine kinase
CPR	Cardiopulmonary resuscitation
CT	Contrast tomography
DBP	Diastolic blood pressure
ECG	Electrocardiogram
EMERAS	Eotudio Maltecentrio Estreptoquinase Republic de America del Sur
GISSI	Gruppo Italiano Per lo Studio Della Streptokinase Infarction Myocardico
GUST	Global utilization strategies to open occluded coronary vessels
HIT	Herudin for improvement of thrombolysis
ICCU	Intensive coronary care unit
ICH	Intracranial haemorrhage
IHD	Ischaemic Heart Disease
ISIS	International study of infarct survival
LAD	Left anterior descending artery
LATE	Late assessment of thrombolytic efficiency
LCX	Left circumflex coronary artery
LVF	Left ventricular failure
MRI	Magnetic resonance imaging

PET	Position Emission Tomography
PTCA	Percutaneous transcoronary angioplasty
r.PA	Reteplase
RCA	Right coronary artery
SBP	Systolic blood pressure
STEMI	ST segment elevation myocardial infarction
STR	ST segment resolution
STSER	ST segment elevation resolution
TIMI	Thrombolysis in myocardial infarction
TNK-tPa	Tenecteplase
tPA	Tissue plasminogen activator
VF	Ventricular fibrillation
VT	Ventricular tachycardia
WBC	White blood cells

ABSTRACT

Background and Objectives

Acute Myocardial Infarction is one of the leading causes of mortality and morbidity in India. The treatment of Acute myocardial infarction is based upon the time interval and availability of Primary PCI, Even now in many centres thrombolysis is the initial treatment of choice. Now there are a number of drugs for Thrombolysis but still Streptokinase is used in many of the centres because of the ease of availability and less cost. Simple and rapid measures are needed for timely assessment of quality of reperfusion therapy in acute STEMI

ST segment elevation resolution following thrombolysis is simple, non-invasive, accessible tool for the assessment of coronary reperfusion. Objective of the present study was to assess the efficacy of thrombolysis with respect to time interval in Acute STEMI patients with regard to symptom relief, resolution of ST-elevation on treatment with streptokinase. And also to predict short term outcome during hospital stay in terms of adverse events and mortality.

Method:

A total of 60 patients at their first episode of AMI admitted within 24 hours from the onset of chest pain were included in the study. Once diagnosis of STEMI made and thrombolytic therapy was given, all patients were categorized into 3 groups, categorized on duration from onset of chest pain to administration of thrombolytic therapy, Patients

received thrombolytic therapy with 1.5 million IU of streptokinase in 100 ml of normal saline over 45 minutes,

Group-I -0 to 3 hours (27 patients) – 45%

Group-II -3 to 6 hours (14 patients) – 23.33%

Group-III -6-12 hours (19 patients) – 31.67%

Based on percentage resolution of ST segment elevation at 90 min following therapy, patients were divided into three groups: > 70% resolution (complete resolution group), 30%-70% (partial resolution group) and < 30% (no resolution group). All the patients were followed up for in-hospital complications and mortality,

RESULTS

Of 60 patients, 9 patients (15%) had < 30% ST resolution (no STR), 26 patients (43.3%) had 30-70% ST resolution (partial STR), 25 patients (41.7%) had > 70% ST resolution (complete STR). During hospital stay adverse events including death for no resolution group was 100%, for partial resolution group was 69.2% and for complete resolution group was 28%.

CONCLUSION

Patients with no resolution of ST segment 90 minutes following thrombolysis associated with more frequent adverse events and increased mortality compare to partial and complete resolution group. And patients thrombolyzed earlier had better results and less complications.

KEY WORDS: Acute myocardial infarction;ST segment resolution; Thrombolysis

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Thrombolysis therapy has been shown in randomized controlled trials to improve the natural history of acute myocardial infarction with approximate 30% reduction in mortality. Non-invasive detection of reperfusion is an useful guide to future treatment. Resolution of ST segment elevation following thrombolytic therapy has been shown to be a simple and useful predictor of left ventricular function and clinical outcome.

This study is an effort to study the patients with acute myocardial infarction comparing their ECG findings on admission and subsequently after thrombolysis. And the outcome of thrombolytic therapy in terms of mortality and morbidity during hospital stay.

Acute myocardial infarction is a major scourage of our times. It assumes increasing importance as it affects people in the most productive period of their life.

The mortality and morbidity caused by acute myocardial infarction are major public health concern in the industrialized world and also slowly becoming a leading cause of mortality in developing countries as infectious diseases began

to come under control with newer chemotherapeutic agents. Incidence in West has decreased due to the better care and treatment.

Primary goal of therapy in ST elevation myocardial infarction has been to restore normal blood flow in the occluded epicardial coronary artery as rapidly as possible. Early and sustained patency of infarct related artery is necessary, to ensure optimal outcome of reperfusion therapy. So optimal goal of reperfusion therapy is to establish nutrient blood flow at tissue level.

Reduction in ST segment elevation, relief from chest pain, early peaking of serum concentration of creatine kinase and reperfusion arrythmias are some of the non-invasive markers of reperfusion.

Chest pain resolution and biochemical markers failed to satisfy the clinical necessities. In the last decade several observations led to ST segment elevation resolution as rapid, simple and inexpensive marker for assessing the success or failure of reperfusion therapy.

Schroder K et al. commented that ST segment resolution as measured by two cut-off points, one at 70% and other at 30% from start of thrombolysis significantly predicts enzymatic infarct size.[1]

Farrer M et al. suggested that previous studies have shown an association between each resolution of ST elevation after thrombolysis and improved coronary patency and clinical outcome.[2]

Since 1987 Anthon K et al. work on critical role of coronary thrombosis in acute myocardial infarction has been confirmed. This provides the scientific basis for thrombolytic therapy, the advent of which has been the cause of much global excitement and revolutionized the treatment of AMI.[3]

The thrombolytic agent available for clinical outcome in our study is streptokinase.

OBJECTIVES

To assess the efficacy of thrombolytic therapy with IV streptokinase in Acute ST elevation Myocardial Infarction patients in terms of:

- ST segment resolution after thrombolysis.

- To compare the ST segment resolution who were thrombolyzed within different time intervals

- To study ST segment resolution with its correlation to clinical outcome and early complication.

REVIEW OF LITERATURE

HISTORICAL REVIEW:

Although myocardial infarction is often depicted as a modern disease it was clearly recognized before the modern era. There were references to what could be recognized today as angina pectoris, myocardial infarction and sudden death in ancient Egyptian, Greek, Biblical and Thelmudic sources. William Heberden in 1768 presented his classic description of angina pectoris in a lecture before the Royal College of Physicians and it was published in 1772[45].

Caleb Parry, a physician in Bath read a paper on coronary disease to local medical society in 1788. An early personal description of myocardial infarction was given by John Hunter, Surgeon to St George Hospital, London, who himself experienced what was probably a myocardial infarction in 1773. The description of his subsequent autopsy describes the scarred areas in his heart.

Adam Hammer, a physician in Monneheim, is credited with the first antemortem diagnosis of coronary thrombosis with an autopsy showing a clot in a coronary artery in 1898.

Sir William Osler in 1910, delivered a lecture to the Royal College of Physicians, which noted that he had found the condition to be more common amongst his private or upper class patients than the poorer classes he saw at St.Bartholomew's hospital, noting also the tendency of the disease to have a familial disposition. He thus combined the modern etiological theories of the interaction between environment and genetics[46].

Acute myocardial infarction was considered universally fatal until it was

James Herrick, a Chicago Physician who in 1912 described the clinical features of sudden obstruction of coronary arteries. He also described survival of patient after such an event[47].

Streptokinase, an exogenous activator of the fibrinolytic system was first described by Tillet and Garner in 1933. They discovered that a filtrate of beta-hemolytic strains of streptococcus could dissolve human thrombus[48].

Canine experiment by Tennant and Wiggens, in 1935 showed that temporary occlusion of a coronary artery resulted in localized myocardial dysfunction and that reperfusion of the affected area frequently resulted in complete recovery of muscle function[49].

Sherry in 1954 subsequently described the interaction between streptokinase and the human fibrinolytic system, which resulted in the conversion of plasminogen to plasmin[48].

Selective coronary angiography was first performed by Mason Sones in 1957 and the angiogram is still considered the gold standard for the evaluation of coronary artery anatomy and pathology[50].

Ruegsegger et al[51] in 1959 first demonstrated successful lysis of experimentally induced thrombi by intracoronary administration of fibrinolytic in dogs.

Favaloro RG et al[52] in 1971 developed first effective coronary bypass grafting using reversed saphenous veins. He also concluded that treating an acute MI with coronary bypass grafting within 6 hours of onset could reverse the effects of acute MI limit infarct size and improve MI postoperatively.

Kordenat and Kedzi in 1972 demonstrated that electrocardiographic and hemodynamic improvement occurred after successful intracoronary thrombolysis in dogs[53].

Berg and colleagues[54] from Spokane, Washington in 1975 published one of the first papers advocating the use of CABG for the treatment of acute MI and showed the benefit of surgical intervention by decreasing mortality rates significantly when revascularization was accomplished in < 6 hours.

Chazer ET et al[55] in 1976 first reported immediate arteriographic recanalization following intracoronary injection of streptokinase during STEMI.

Reimer KA et al[56] in 1977 demonstrated in a canine model that occlusion of coronary artery is followed by a wave front of myocardial necrosis spreading from endocardium to the epicardium, with an inverse relation between the time to reperfusion and the ultimate size and extent of transmurality of the infarct.

Rentrop and co-workers in 1979 demonstrated acute reperfusion of occluded infarcted arteries with intracoronary streptokinase[57].

Dewood et al[58] in 1980 studied 517 patients with acute infarct who underwent coronary arteriography and left ventriculography within 24 hours after the onset of symptoms. 90% of the patients had coronary thrombi within the first 4 hours and frequency fell to 54% between 12 and 24 hour after symptom onset. Thus, they identified thrombotic occlusion of an epicardial coronary artery as the usual proximate cause of transmural AMI in patients.

Kloner et al[59] in 1983 demonstrated in the dog that a rim of sub-epicardial myocardium could be salvaged when reperfusion occurred within 6 hours of coronary occlusion.

Anderson et al[60] in 1983 randomized 50 patients with chest pain of less than four hours duration and persistent ST-segment elevation, Intracoronary streptokinase treated patients had significant improvement in global ejection fraction 10 days after therapy. Reperfusion rate in streptokinase treated patients was 79% with significant improvement in echocardiographic wall motion index and less loss of R-wave amplitude compared to control. A trend towards decreased mortality occurred in the streptokinse-treated group, but it did not reach statistical significance.

The Western Washington Randomized Trial conducted in 1983 evaluated the effects of intracoronary streptokinase in 250 patients to control. Recanalization was achieved in 68% of streptokinase group. 30 day mortality was reduced to 3.7% in streptokinase treated group as compared to 11.2% in control. The mortality at 6 month was 3.7% in streptokinase group as compared to 14.7% in control[61].

The Netherlands Interuniversity Cardiology Institute Trial in 1983 allocated 264 patients to conventional treatment and 269 to intracoronary streptokinase. The last 117 were first treated with 500000 units of intravenous streptokinase. Time to treatment was 80 minutes faster than in the Western Washington trial and the recanalization rate was higher (79%). Mortality rate at 28 days were significantly reduced with streptokinase (5.9 versus 11.7%)[62].

Shoeder R et al[63] in 1983 derived empirically the conventional dose of 1.5 million unit over 60 minutes for intravenous streptokinase.

Yusuf et al[64] in their overview of 24 randomized intravenous streptokinase trials and 9 intracoronary streptokinase trials in 1985 showed that IV treatment produced a highly significant 22% reduction in odds of death. There was an even larger reduction in the odds of reinfarction, and an absolute frequency of serious adverse effect to set against this that is much smaller than absolute mortality reduction. The apparent size of the mortality reduction in the IV trials was similar whether treatment began early (<6 hour) or late (generally 12-24 hours).

The ISAM trial in 1986 randomized 1741 patients to intravenous streptokinase or control within six hours of symptom onset. Mortality at 21 days was 6.3% in streptokinase treated group and 7.1% in placebo. Mortality was 5.2% and 6.5% in streptokinase treated group and placebo respectively when treated <3 hours from symptom onset. Thus they concluded that beginning IV streptokinase early after the onset of myocardial infarction limits the size of the infarct regardless of its localization and however, there was only a trend towards reduced mortality at 21 days[65].

In the GISSI study conducted in 1986, a total of 11806 patients were randomized to either intravenous streptokinase or control within 12 hours of symptom onset. At 21 days overall hospital mortality was 10.7% in streptokinase versus 13% in

control, an 18% reduction. The benefit was most striking in patients treated within 3 hours (relative risk 0.74) from symptom onset, it remained statistically significant in 3-6 hour group (0.80). A non-statistically significant reduction of mortality in 6 to 9 hour (0.87) group and this difference reversed in the 9 to 12 hours group (relative rate 1.19) probably because numerator and denominator in the late treated group were very small producing unstable estimates[66].

The ISIS-2 trial in 1988 randomized 17187 patients within 24 hours of the onset of symptoms of suspected myocardial infarction to streptokinase, aspirin both or neither. Streptokinase alone reduced five week vascular mortality (9.2% versus 12%) and the combination of aspirin plus streptokinase additionally reduced mortality (8% versus 13.2%). There was evidence of benefit even for patients treated late after pain onset odds reductions at 5-12 and 13-24 hours was 16% and 21% for streptokinase alone, 32% and 38% for combination of streptokinase and aspirin[67].

In ISIS-3 conducted in 1992, patients were eligible if they were thought to be within 24 hours of the onset of acute myocardial infarction and were randomly allocated to receive streptokinase, anistreplase and tissue plasminogen activator. All patients received aspirin and half were randomly allocated to subcutaneous heparin. There was no significant difference in survival at 35 days within any of the six possible treatment combination[68].

The EMERAS trial in 1993 found an insignificant 14% reduction (11.7% versus 13.2%) in hospital mortality in 2080 patients randomized to streptokinase or placebo 6-12 hours after symptom onset. Whereas there was little difference in hospital Mortality among the 1791 presenting after 13-24 hour (11.4% versus 10.7%)[69].

The Late Assessment of Thrombolytic Efficacy (LATE) study in 1993 randomized 5,711 patients with symptoms between 6 and 24 hours from onset to alteplase or placebo. A significant 26% reduction in 35 days mortality (8.9 versus 12%) was found in the 6-12 hours group. Rates were 8.7% and 9.2% respectively, for those treated at 12-24 hours but subgroup analysis of patients who were randomized promptly after admission and treated without any delay showed

benefit from thrombolysis throughout the 6-24 hours. Patients in this group treated within 12 hours of symptom onset had 30% reduction and those treated after 12 hour a reduction of 19% in mortality[70].

Fibrinolytic therapy trialists (FTT) collaborative group in 1994 over viewed 9 trials which randomized patients with suspected acute myocardial infarction to fibrinolytic therapy or placebo. Among 45,000 patients randomized highly significant morality reduction of 30 per 1000 for 0-6 hours group, 20 per 1000 for 7-12 hours group was observed. Statistically uncertain benefit of about 10 per 1000 for 13-18 hours group noticed. This overview indicated that the gradual diminution in benefit with fibrinolytic therapy may be due to the association of later treatment with a larger excess of death[71].

Topol et al[72] in 1992 randomized 197 patients with 6 to 24 hours of symptom onset to tissue plasminogen activator or placebo. Patients were again randomized to angioplasty or no angioplasty if found to have occluded infarct related artery on angiogram after 24 hour. Infarct vessel patency was achieved in 65% of tpA treated patients as compared to 27% in placebo. At 6 months infarct vessel patency was 59% in both group but there was significant increase in end-diastolic volume with increased left ventricular cavity size in placebo group compared to thrombolyzed patients.

Igawa et al[73] in 1993 categorized 22 patients with first acute anterior wall MI into four groups:

Group-A (n=5): Patients who had with successful reperfusion within 6 hours.

Group-B (n=6) patients with late patency of the infarct related artery, Group-C (n=6 patients) without recanalization out with good collaterals. Group-D (n=5 patients) without recanalization and poor or no collaterals. The left ventricular size and function were preserved better in group-A than in others as evaluated by contrast left ventriculography.

Although there was no difference in regional wall motion of the infarct area among group B, C and D. The EF was greater and the percentage perimetric circumference was smaller in groups B and C than in D.

Also the left ventricular end-diastolic volume was greater in D, thereby suggesting that blood supply to the infarct area is essential for the preservation of left ventricular size and function regardless of the timing and route.

Leoncini M et al[74] in 1994 evaluated the effectiveness of late thrombolysis (6-24 hours) in 15 patients with pre and post treatment perfusion scintigraphy with TC-99m sestambi.

7 patients with perfusion recovery (group-1) showed significant decrease in uptake score compared to 8 ptients with absent or minimal perfusion recovery after thrombolysis (group-II). Defect score further reduced in group-I patients along with decrease in asynergic score assayed by 2D echo significantly after 35 days compared to group II patients.

Coronary angiogram performed 6-9 days showed patent vessel in all patients of group-I as compared to only 2 patients of group-II. EF increased from 38% to 47% in group I as compared to unchanged 40% as assayed by gated blood pool imaging after 35 days.

Thus, it was demonstrated that it is still possible to obtain an effective reperfusion and the consequent salvage of jeopardized tissue demonstrated by recovery of both regional and global left ventricular function.

Romero et al[75] in 1996 randomized 21 patients with acute anterior wall MI presenting between 6 to 12 hours of symptom onset to streptokinase plus aspirin (n=12), or aspirin alone (n=9). Myocardial expansion evaluated by 2-D echo in terms of distortion area, distortion peak, septal thickness were present in 25% of thrombolyzed patients to 66.6% of placebo group.

Blood Supply of Heart[5]

The circulation of blood in the blood vessels that supply blood to and from the heart muscle itself is coronary circulation. Although blood is present in the chambers of the heart, the muscles of the heart are so thick that it a separate blood supply, these vessels which supply blood to the heart are called Coronary arteries and their counterpart which removes impure blood from the heart are called cardiac veins

The heart is supplied by the left and the right coronary arteries. The left main coronary divides into the left anterior descending artery (LAD) and the left circumflex artery LCX. The Left Anterior Descending lies in the groove called the anterior interventricular groove, supplies the septum , anterior wall and apex of the left ventricle. The circumflex artery gives marginal branches that supply the lateral, posterior and inferior segments of the left ventricle.

The right coronary artery (RCA)- lies in right AV groove, it supplies RA, RV and postero-inferior part of LV. The posterior descending artery perfuses the posterior surface of the heart.

Left anterior descending coronary artery

The Left Anterior Descending artery supplies blood to the anterior wall especially via the diagonal branches (segments 1, 7, and 13), the anterior part of the septum via the septal branches (segments 2, 8, and part of 14; sometimes segment 14 is co-perfused by the Right Coronary Artery), and also the areas 3 and 9 which are also co-perfused by Right Coronary Artery.

Often the Left Anterior Descending artery supplies blood to apical portion of the heart and the inferior wall and the Left anterior descending artery winds around the apical portion of the heart in around 80% of subjects, sometimes the RBB is supplied by the initial septal branch. [5]

Right coronary artery

Right Coronary artery supplies blood to the RV, the inferior part of the inter-ventricular septum (areas 3 &9). Area 14 is perfused by Left Anterior Descending artery, but in some subjects it is perfused by either artery. The Right Coronary Artery also supplies blood to a major portion of the inferior wall (area 4, 10 and 15). These areas 4 and 10 can also be supplied by the Left Circumflex artery,

Finally the Right Coronary Artery supplies blood to area 17 if the Left Anterior Descending is small, The Atrio-ventricular Node is supplied by the Posterior descending artery which is a branch of RCA.[5]

Circumflex coronary artery

The Left Circumflex artery supplies blood to lateral surface, base of anterior wall (area 6), the middle and lower areas are shared with the Left Anterior Descending (areas 12 and 16) and the whole part of the lateral wall (area 5 and 11) in the left dominant circulation. The LCX artery is dominant it supplies the major portion of the the inferior wall of the ventricle especially areas 4 and 10, rarely areas 15 and 17. [5]

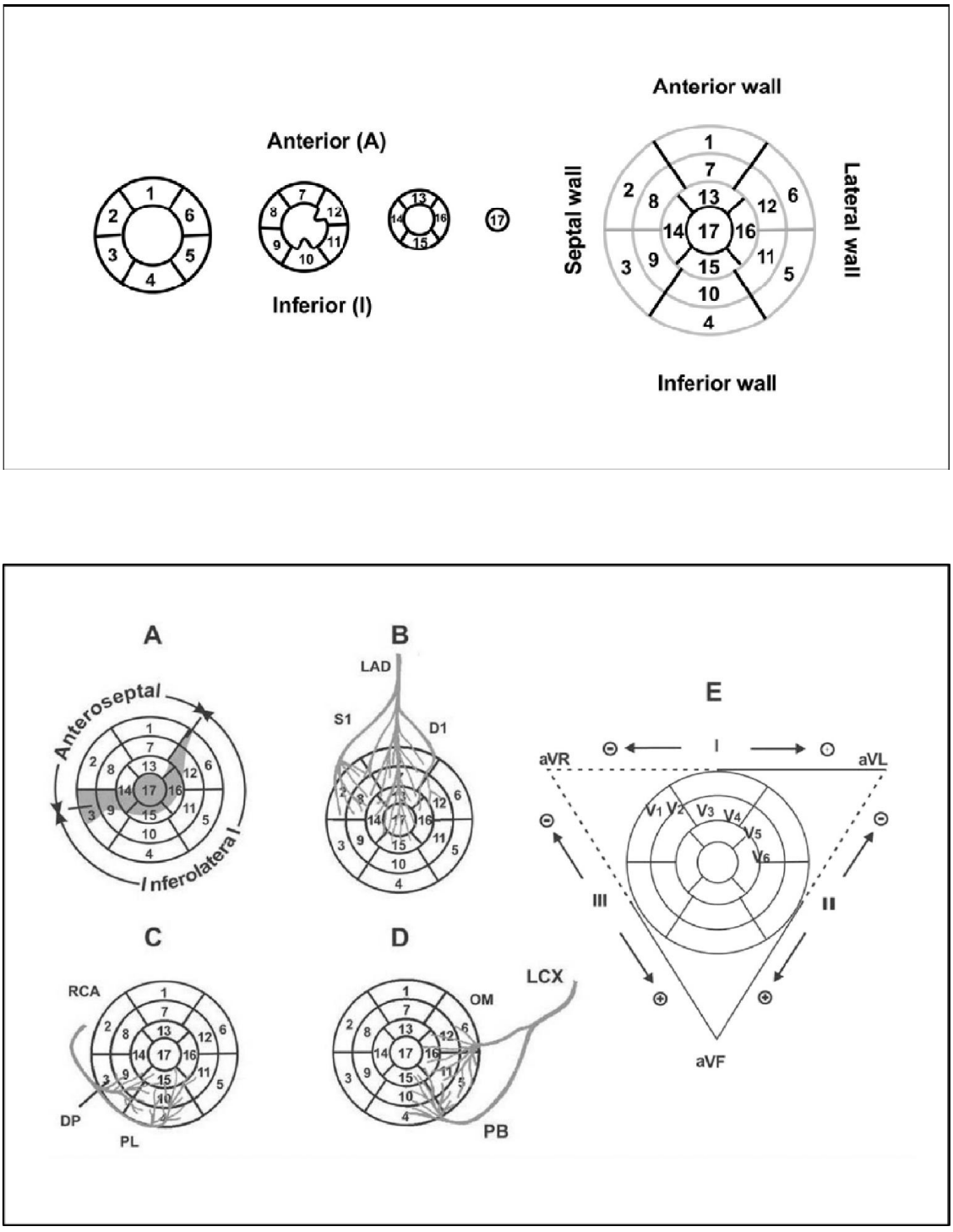


Figure 1: Circumflex coronary artery[5]

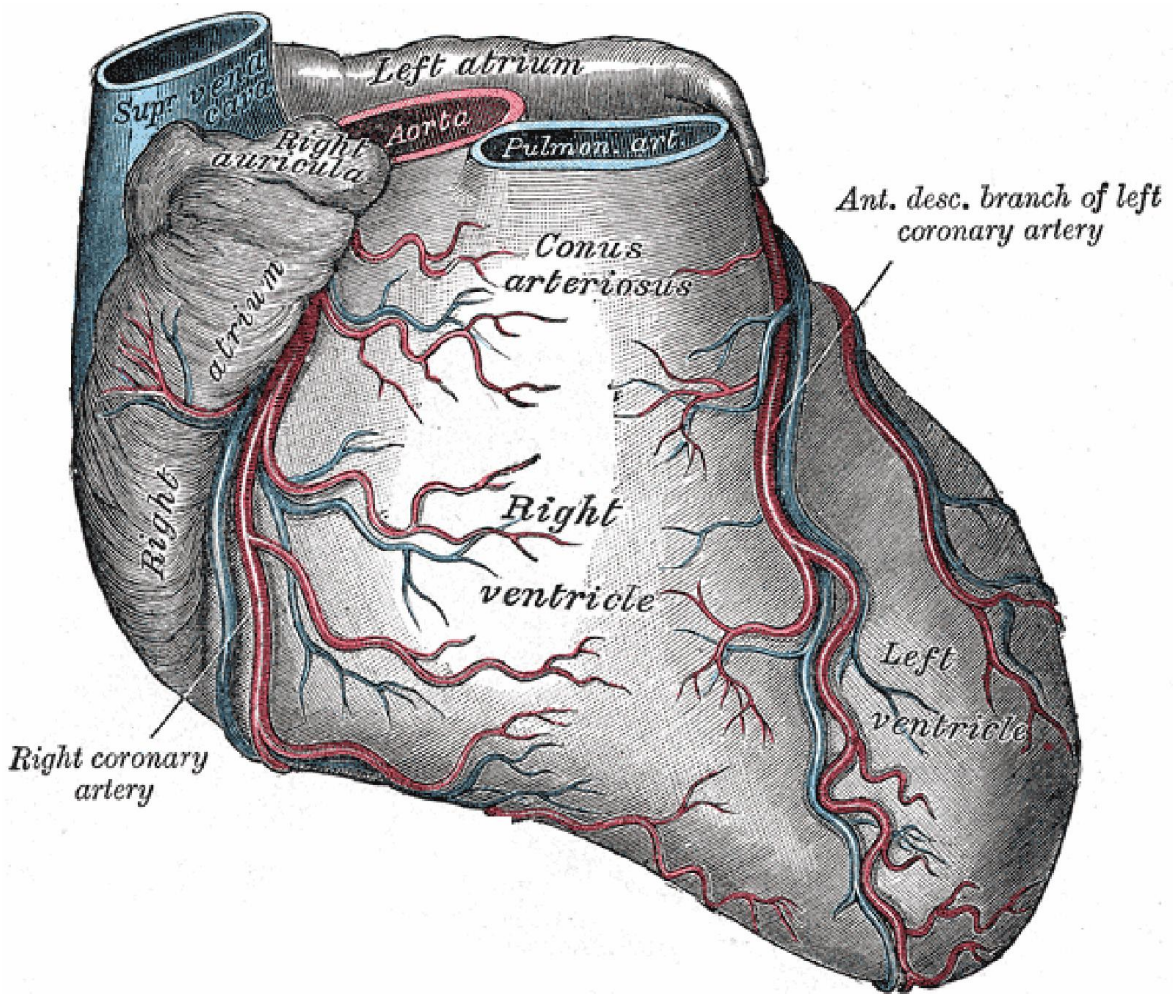


Figure 2: Coronary circulation[5]

The definition of acute myocardial infarction[6]

Myocardial infarction can be defined from a number of different perspectives

It is well known that the term myocardial infarction reflects death of cardiac cells caused by prolonged ischemia.

Third Universal Definition of Myocardial Infarction

Definition of Myocardial Infarction

Criteria for acute myocardial infarction

The term acute myocardial infarction (MI) should be used when there is evidence of myocardial necrosis in a clinical setting consistent with acute myocardial ischemia. Under these conditions any one of the following criteria meets the diagnosis for MI:

- Detection of a rise and/or fall of cardiac biomarker values [preferably cardiac troponin (cTn)] with at least one value above the 99th percentile upper reference limit (URL) and with at least one of the following:
  - Symptoms of ischemia.
  - New or presumed new significant ST-segment–T wave (ST-T) changes or new left bundle branch block (LBBB).
  - Development of pathological Q waves in the ECG.
  - Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.
  - Identification of an intracoronary thrombus by angiography or autopsy.
- Cardiac death with symptoms suggestive of myocardial ischemia and presumed new ischemic ECG changes or new LBBB, but death occurred before cardiac biomarkers were obtained, or before cardiac biomarker values would be increased.
- Percutaneous coronary intervention (PCI) related MI is arbitrarily defined by elevation of cTn values (>5 × 99th percentile URL) in patients with normal baseline values (≤99th percentile URL) or a rise of cTn values >20% if the baseline values are elevated and are stable or falling. In addition, either (i) symptoms suggestive of myocardial ischemia or (ii) new ischemic ECG changes or (iii) angiographic findings consistent with a procedural complication or (iv) imaging demonstration of new loss of viable myocardium or new regional wall motion abnormality are required.
- Stent thrombosis associated with MI when detected by coronary angiography or autopsy in the setting of myocardial ischemia and with a rise and/or fall of cardiac biomarker values with at least one value above the 99th percentile URL.
- Coronary artery bypass grafting (CABG) related MI is arbitrarily defined by elevation of cardiac biomarker values (>10 × 99th percentile URL) in patients with normal baseline cTn values (≤99th percentile URL). In addition, either (i) new pathological Q waves or new LBBB, or (ii) angiographic documented new graft or new native coronary artery occlusion, or (iii) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

Criteria for prior myocardial infarction

Any one of the following criteria meets the diagnosis for prior MI:

- Pathological Q waves with or without symptoms in the absence of non-ischemic causes.
- Imaging evidence of a region of loss of viable myocardium that is thinned and fails to contract, in the absence of a non-ischemic cause.
- Pathological findings of a prior MI.

Types of Myocardial Infarction

The Third Universal Definition of MI consensus group defines various types of MI it is as follows

Type 1: Spontaneous myocardial infarction

Spontaneous myocardial infarction related to atherosclerotic plaque rupture, ulceration, Assuring, erosion, or dissection with resulting intraluminal thrombus in one or more of the coronary arteries leading to decreased myocardial blood flow or distal platelet emboli with ensuing myocyte necrosis. The patient may have underlying severe CAD but on occasion non-obstructive or no CAD.

Type 2: Myocardial infarction secondary to an ischemic imbalance

In instances of myocardial injury with necrosis where a condition other than CAD contributes to an imbalance between myocardial oxygen supply and/or demand, e.g. coronary endothelial dysfunction, coronary artery spasm, coronary embolism, tachy-/brady-arrhythmias, anemia, respiratory failure, hypotension, and hypertension with or without LVH.

Type 3: Myocardial infarction resulting in death when biomarker values are unavailable

Cardiac death with symptoms suggestive of myocardial ischemia and presumed new ischemic ECG changes or new LBBB, but death occurring before blood samples could be obtained, before cardiac biomarker could rise, or in rare cases cardiac biomarkers were not collected.

Type 4a: Myocardial infarction related to percutaneous coronary intervention (PCI)

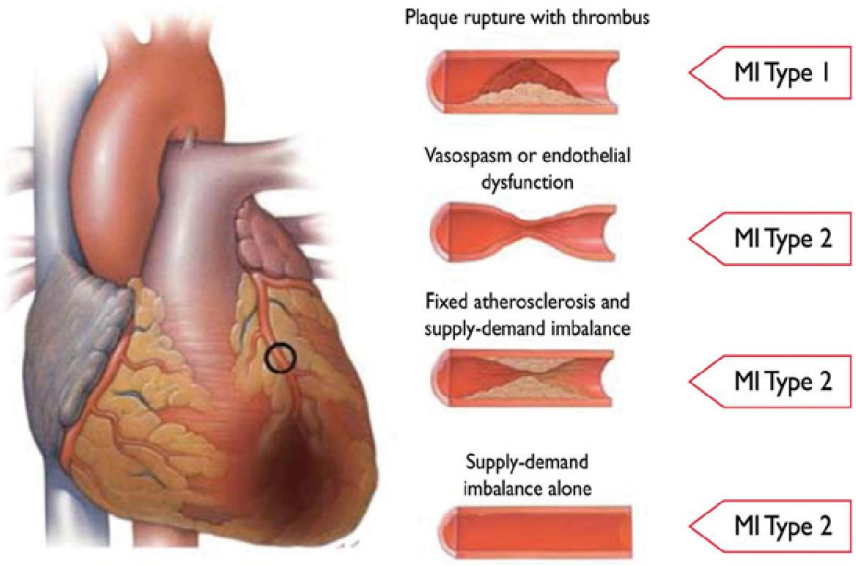
Myocardial infarction associated with PCI is arbitrarily defined by elevation of cTn values >5 x 99th percentile URL in patients with normal baseline values (<99^{th} percentile URL) or a rise of cTn values >20% if the baseline values are elevated and are stable or falling. In addition, either (i) symptoms suggestive of myocardial ischemia, or (ii) new ischemic ECG changes or new LBBB, or (iii) angiographic loss of patency of a major coronary artery or a side branch or persistent slow- or no-flow or embolization, or (iv) imaging demonstration of new loss of viable myocardium or new regional wall motion abnormality are required.

Type 4b: Myocardial infarction related to stent thrombosis

Myocardial infarction associated with stent thrombosis is detected by coronary angiography or autopsy in the setting of myocardial ischemia and with a rise and/or fall of cardiac biomarkers values with at least one value above the 99th percentile URL.

Type 5: Myocardial infarction related to coronary artery bypass grafting (CABG)

Myocardial infarction associated with CABG is arbitrarily defined by elevation of cardiac biomarker values >10 x 99th percentile URL in patients with normal baseline cTn values (<99th percentile URL). In addition, either (i) new pathological Q waves or new LBBB, or (ii) angiographic documented new graft or new native coronary artery occlusion, or (iii) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.



Causes of Myocardial Infarction

1. Congenital anomalies:
    a) Anomalous origin from the aorta.
    b) Single coronary artery
    c) Atresia of coronary ostium
    d) Osteal ridges
    e) Myocardial bridges

2. Embolus:
    i) Natural
    ii) Tumour
    iii) Calcium
    iv) Vegetation
    v) Iatrogenic
    vi) Cardiac surgery
    vii) Prosthetic valves

3. Dissection:
    a) Coronary artery
    b) Aortic

4. Trauma:

    a) Non-penetrating

    b) Penetrating

    c) Surgery

5. Arteritis:

    a) Takayasu's disease

    b) Polyarteritis nodosa

    c) Systemic lupus erythematosus

    d) Kawasaki syndrome.

6. Metabolic disorders:

    a) Mucopolysaccharoidosis

    b) Homocystinuria

    c) Fabry's disease

    d) Amyloid

7. Intimal proliferation:

    a) Irradiation therapy

b) Fibromuscular hyperplasia

8. External compression:

a) Aortic aneurysm

b) Tumor metastasis

9. Thrombosis without underlying atherosclerotic plaque

a) Polycythemia

b) Thrombocytosis

c) Hypercoagulability

10. Substance abuse

a) Cocaine

b) Amphetamines

11 Myocardial oxygen demand-supply disproportion

a) Aortic stenosis

b) Systemic hypertension

11. Intramural coronary disease:

a) Hypertrophic obstructive cardiomyopathy

b) Neuromuscular

Thrombolytic Therapy[8]

It will be discussed under the following

1. Definition
2. Characteristics, aims and objectives of fibrinolysis
3. Classification and newer thrombolytic agents, comparative features of newer agents.
4. Guidelines
5. Contraindications
6. Clinical benefits of thrombolysis
7. Complications
8. Assessment of myocardial reperfusion
9. Conjunctive Treatment

1. Definition[8]

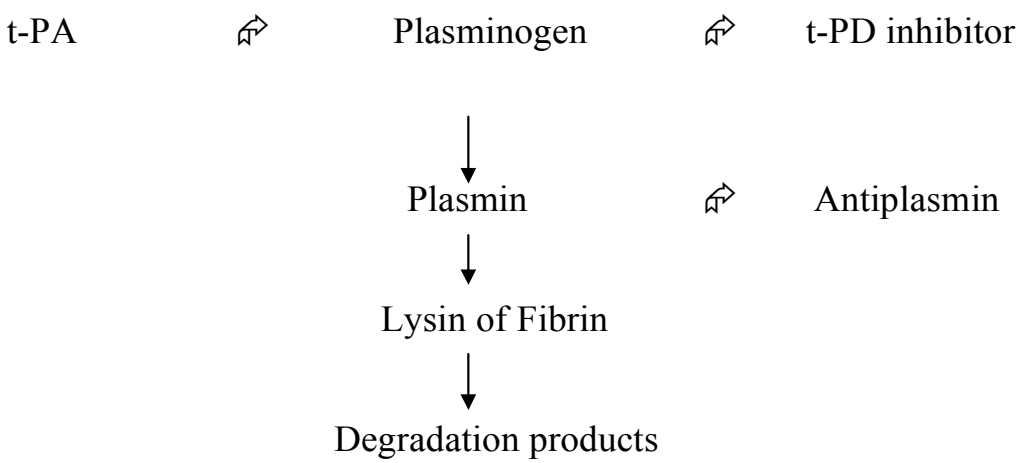
Thrombolytic can be defined as a substance which causes lysis of the thrombi to recanalize the occluded blood vessel.

Thrombus can be defined as a mass of aggregated platelets adherent to the vessel wall and immobilized with fibrin.

2. Characteristics - Objectives of Fibrinolysis[8]

Thrombus is formed. The fibrinolytic system is activated so as to dissolve the thrombus and re-establish normal blood flow. Normally, thrombolysis is initiated by the release of intrinsic thrombolytic agents like tissue plasminogen or prourokinase.

During the formation of thrombus large amount of plasminogen from the circulation is trapped in the thrombus. TPA released from the injured vascular endothelium converts this inactive plasminogen to plasmin. Plasmin digests the fibrin threads and thus dissolves the clot.



Though thrombolysis begins immediately after vascular injury, Clot lysis and vessel recanalization may not be complete upto 7-10 days. This process can be enhanced by exogenous extrinsic activator for therapeutic purpose. All thrombolytics act by activation of plasminogen to plasmin either directly/indirectly.

Objectives of Fibrinolysis

1) To cause lysis of the thrombus within the occluded artery responsible for the damage.

2) To cause decrease in plasma viscosity and red cell sludging by digestion of fibrinogen and high molecular weight fibrinogen-fibrin complexes.

3) To cause lysis of thrombi in the coronary vessel adjacent to the infarct.

3. Classification and Newer Thrombolytic agents formulated (Blann AD et al.)[8]

	Streptokinase	**Urokinase**	**APSAC**	**t-PA**
Source	**From culture filtrate of β streptokinase**	**From human renal cell culture**	**Complex of streptokinase human plasminogen**	**Recombinant DNA technique**
Plasma binding	Indirect	Direct	Indirect	Direct
Fibrin specificity	Minimal	Moderate	Minimal	Moderate
Systemic lysis	High	High	High	Low
Bleeding site	High	High	High	High
Antigenicity	Yes	No	Yes	No
Allergic state	Yes	No	Yes	No
Acute coronary patency rate	40-60%	50-70%	60-70%	60-85%
Metabolism	Liver	Liver	Liver	Renal

Summary of Thrombolytic Agents in Clinical Practice of Clinical Trails[8]

Agents	**Comments**
First-generation Streptokinase	Plasma half-life 18-25 min; patency at 90 min is 40%, and 32% achieve TIMI-3 flow; incidence of intracerebral hemorrhage about 0.3%; antigenic and therefore not used within 5 days to 2 years after prior administration; about 25 lives saved per 1.000 treated. Dose 1.5 million units over 1 hour intravenously.
Urokinase	Plasma half-life 15 min;not considered antigenic; administration as 1.5 million units intravenous bolus, followed by 1.5 million units over 90 minutes.

Anisoilated plasminogen streptokinase activator complex	Plasma half-life 100 minutes; patency at 90 minutes is 63%, and 43% achieve TIMI-3 flow; incidence of intracerebral haemorrhage is 0.6%; antigenic; about 25 lives saved per 1.000 treated; dose: 30 mg over 5 minutes intravenously.
Second-generation Tissue-type Plasminogen activator rt-PA (one chain), t-PA (two chain), alte-plase (by recombinant technology)	Plasma half-life 5 minutes. Plasma half-life 5 minutes; no antigenicity and causes moderate systemic fibrinogen depletion; about 35 lives saved per 1,000 treated; dose: 1) accelerated t-PA: administered as 15-mg bolus intravenously, then 50 mg over 30 min, and 35 mg over the next 60 minutes; 2) 100 mg over 90 minutes intravenously.

Single-chain urokinase type plasminogen activator (r-scu-PA, Saraplase, Prourokinase) Staphylokinase	Plasma half-life 5 minutes; effect requires concomitant use of heparin and even enhanced with preliminary bolus of heparin; reported to have higher rate of intracranial hemorrhage; dose 20 mg intravenous bolus. Plasma half-life 1-2 minutes; high fibrin selectivity; limited systemic plasminogen activation; associated with high incidence of antibody formation; dose: 10 mg intravenously over 30 min.
Third-generation Mutant TNK-tPA	Reduced plasma clearance with prolonged plasma half-life; can be administered as single intravenous bolus; 14 times more fibrin selective than t-PA; 80 times more resistant to PAI-1; intrinsically less thrombogenic and causes less platelet aggregation; dose; 30-40 mg Intravenous bolus.

r-PA (Reteplase)	Deletion mutant of t-PA; preferential binding of fibrin-bound plasminogen; plasma half-life 18 minutes; does not require body weight adjustment.
n-PA (Lanoteplase)	Plasma half-life 37 minutes; improved lytic activity relative to t-PA; reduced fibrin affinity.
Vampire bat plasminogen activator	Long plasma half-life, 2.8 hours; can be produced by recombinant technology; highly fibrin selective; can induce antibody formation.

4. ACC/AHA guidelines for administration of thrombolytic therapy to patients with AMI (Braunwald E et al.)[9]

Indication	**Class I**	**Class IIa**	**Class IIb**	**Class III**
Thrombolysis	ST segment elevation (>0.1 mV in two or more contiguous leads), time to therapy ≤ 12 hr, age < 75 yr. New onset LBBB (obscuring ST segment analysis) and history suggesting AMI ≤ 12 hr	ST segment elevation age ≥ 75 yr	ST segment elevation, time to therapy >12 to 24 hr Blood pressure on presentation > 180 mm Hg systolic and/or > 110 mmHg	ST segment elevation time to therapy greater than 24 hours, ischemic pain resolved. ST segment depression only

Fibrinolytic agents used in STEMI[6]

	Initial treatment	**Antithrombin co-therapy**	**Specific contra-indications**
Streptokinase	15 lakh units over 45-60 minutes	Heparin infusion for 1-2 days	History of use of streptokinas
Alteplase	15 mg i.v stat 75 mg/kg in half an hour followed by 0.5 mg/kg in 1 hour maximum dose is 100mg	Heparin infusion for 1-2 days	
Reteplase	20 units in two doses given at least 10 minutes apart	Heparin infusion for 1-2	
Tenecteplase (TNK-tPA)	I.V. Bolus depending upon the body weight 30-50 mg	Heparin infusion for 1-2 days	

5. Contraindications and cautions for Fibrinolysis use in ST-Elevation Myocardial Infarction[10]

Absolute contraindications

- Intra-cerebral hemorrhage in the past
- AV malformation in the brain
- Malignancies in the Brain
- Ischemic CVA in the past 3 months
- Suspicion of dissection of Aorta
- History of bleeding disorder or active bleeding
- History of Head injury in the past 3 months

Relative contraindications

- known hypertensive patient with poor control
- Systolic Blood Pressure more than 180 and Diastolic Blood Pressure more than 110
- Ischemic CVA in the past more than 90 days
- cardio-pulmonary resuscitation more than 10 minutes
- history of vascular puncture at sites non-compressible
- history of exposure to streptokinase in the past
- Pregnancy
- Peptuc Ulcer
- Use of warfarin or other vitamin K antagonist

6. Clinical benefits of Thrombolytic Therapy in acute MI[8]

(a) Mechanisms of benefit

It is evident from both laboratory and clinical studies that the benefits of thrombolytic therapy in AMI are conferred exclusively by restoration of patency of infarct related artery.

i) Magnitude of Benefit

The degree of benefit that can be anticipated following successful lysis of an intracoronary thrombus depends on several factors including the nature of the end point examined, time of evaluation and the amount of myocardium that is salvaged 'Salvage' refers to the preservation of viability and contractility of myocardial cells that would have been irreversibly damaged in the absence of an intervention.

ii) Left ventricular function benefit

Since myocardial salvage is a stated goal for restoring infarct artery patency, measurement of infarct size would be an ideal endpoint for clinical reperfusion studies suggested by Braunwald E et al. Attempts to use LV ejection fraction as a surrogate for infarct size have not been productive because little difference is seen in ejection fraction between treated groups that show a significant difference in mortality. Alternative methods of assessing left ventricular function are end systolic volume or quantity echocardiography.

iii) Mortality Benefit

First largest randomized controlled study assessing the impact of thrombolysis on mortality in patients with AMI was GISSI.[11] In this study 11,806 patients were randomized to either IV streptokinase or standard therapy. Patients were enrolled upto 12 hrs after symptom onset. The overall 3 week mortality was lower in treated patients compared with control group.

(b) Recent additional aspects of thrombolytic therapy[12]

a) Inferior wall MI

Old question remains unsolved, whether aggressive treatment with thrombolysis or angioplasty is warranted in patients with inferior MI given the potential economic cost and medical risks. On average, perfusion in uncomplicated inferior MI is good then, infarction tends to be smaller and damage may be distributed between the two ventricles and conduction system.

Studies done by Grines CL et al.[12] have demonstrated that mortality data available is 8.7% for inferior wall MI not treated with thrombolytic treatment 6.8% mortality in inferior wall MI treated with thrombolytic treatment.

Although the magnitude of benefit may not be as large for patients with

inferior MI as for those with anterior MI this finding relates to the overall size of the infarct rather than to its location. Inferior location may be consideration in the presence of relative contraindication. It should not by itself influence the decision to treatment. Clearly patients with large inferior MI as indicated by ECG criteria or hemodynamic instability resulting from either Right or Left ventricular dysfunction should be considered for aggressive therapy.

b) Advanced age

National guidelines have encouraged increased use of thrombolytic therapy for elderly patients 75 years or older,

Study done by Christiansen CL et al.[13] on 2,659 elderly patients with AMI at Minnesota Community hospital between 1992-1996 showed decreased mortality rates among those who were thrombolyzed.

c) Late Treatment

Braunwald E et al. found that no mortality benefit was demonstrated in LATE[14] and EMERAS[15] trials when thrombolytics were routinely administrated to patients between 12-24 hours.

d) Non-diagnostic ECG

Patients presenting with symptom of AMI but with normal ECG did not demonstrate a mortality benefit from thrombolytic therapy therefore routine treatment of patients with normal ECG is not recommended.

e) Prior Bypass surgery

Remote bypass surgery should not be considered a contraindication to thrombolysis. Graft occlusion thrombolysis is more likely to occur than natural vessel thrombosis which is relatively resistant to thrombolysis due to large thrombus mass and poor flow through the graft resulting in limited delivering of lytic agents.

f) Lytic regimen

Increasing the IV dose of streptokinase 15 lakh unit does not appear to increase efficacy, some studies have shown that streptokinase in dose of 7.5 lakhs is as effective as 1.5 million unit. This dose was arrived empirically although short term weight adjusted high dose rt-PA has been investigated and appears to

improve early patency rates there is a general reluctance to employ an increased dose in an average sized patient in view of the excess intracranial bleeding that was observed in patients receiving rt-PA 150 mg over 6 hours in the TIMI trial held by William JL et al.[16]

ADJUNCTIVE ANGIOPLASTY

Emergency cardiac catheterization of patients receiving thrombolytic therapy with subsequent angioplasty has been evaluated in several studies like Hogg KJ et al.[17] Dilatation of vessels in which patency has been restored by thrombolysis has no proven benefit and may infact be detrimental. In addition, reocclusion rates are not decreased and complication rates are relatively high. Rescue or salvage angioplasty of vessels that remain occluded following thrombolytic therapy may have a clinical role. Although success rates are relatively low and, reocclusion rates are relatively high in this selected group of patients, prognosis may be improved with successful restoration of patency.

7) Complications

(a) Bleeding

The Aim of thrombolysis is to lyse the thrombus in the artery and establish blood flow, since this process involves activation of the plasminogen and the expected

complication is bleeding. A thrombus which is preventing a vascular leak in a blood vessel is also lysed and leads to bleeding

Bleeding can occur in various places and is usually classified as either

(i) Intracranial or

(ii) Systemic

(i) Intracranial

Recent studies signify the incidence and risk factor for intracranial hemorrhage. The risk is around 0.3 - 0.5 %. These complications are rarely diagnosed because a massive infarct or haemorrhage may cause sudden death before imaging studies could be done and the death is usually attributed to cardiac cause.

In ISIS-3[18] trial 0.4% without heparin, 0.6% with heparin the risk of ICH is more with the heparin used group than the other . However there was decreased risk of thrombotic stroke when heparin was used.

IV heparin use in STEMI has increased the risk for intracranial hemorrhage but the risk of a ischemic stroke is less.

(ii) Systemic bleeding

The thrombolyzed Patient is at a high risk for any invasive procedures and also for coronary Angiogram or PTCA.

(B) Immunologic complications

Active compound of streptokinase is produced by beta– hemolytic streptococcus; since it is a common pathogen it leads to frequent allergic reactions.

These allergic manifestations are acute and delayed. Delayed is characterised by fever, arthralgia, leucocytoclastic vasculitis, renal failure, interstitial pulmonary abnormalities.

(C) Hypotension

Hypotension occurs in MI due to failure of ventricles to pump blood, inadequate filling of ventricles etc. Hypotension may occur following thrombolysis due to massive release of vasodilatory chemokines like HMWK and bradykinin.
In a trial it was established that fall of 35 mmHg in systolic BP in patients treated with streptokinase and that 38% had systolic BP <90 mmHg transiently. Hypotension documented in GISSI-2[11] trial 4.4% with streptokinase. In ISIS-3[18] trial 6.8% with streptokinase.

The fall in Blood pressure which occurs in patients treated with streptokinase is due to allergic reaction and it responds well to I.V. Fluids and anti allergic medication and other supportive measures

(D) Myocardial rupture of reperfusion injury

Myocardial reperfusion may lead to release of chemokines from dying cells and leads to further inflammation and also occlusion of micro-circulation by the inflammatory cells.

A study conducted by Essen R et al.[19] showed late thrombolysis may cause reperfusion injury and even cause myocardial rupture leading to death.

This Myocardial rupture was more in patients' thrombolyzed after 12 hours of symptom onset and occurs due to the dissection of the free wall of ventricle which is infarcted.

(E) Thromboembolic Complications

Patients with longstanding valvular heart disease may have a clot in the chambers of the heart and this may be partially lysed and may be embolised to the systemic circulation leading to fatal complications.

8. Assessment of Myocardial Reperfusion

Coronary artery patency and myocardial reperfusion can be assessed soon after completion of administration of thrombolytic therapy and also following discharge of such a patient from the hospital. Hence it can be assessed in two stages.

a) Early assessment

b) Late assessment

Early assessment

i) Relief of pain

Earliest symptom of reperfusion is the prompt relief of chest pain followed by a sense of well being.

ii) Resolution of ST segment deviation:

Successful reperfusion is usually followed by rapid return of ST segment

towards the base line. Brockrmeirer J et al.[20] reported a reduction in ST segment elevation to 50% of pre-treatment value within one hour of myocardial reperfusion. In contrast ST segment elevation persisted for a longer time in patients with no reperfusion.

iii) Cardiac enzymes

Following reperfusion when antegrade coronary flow is re-established an abrupt and marked acceleration of CK wash out results in steep rise in serum CK activity. A peak CK level is usually reached in 10-14 hours in patients with early reperfusion following thrombolytic therapy in contrast to 20-25 hours in those patients with conventional treatment.

To obtain CK-MB time activity curve, blood must be collected for determination of CK-MB at 15-30 minutes interval for the initial 2-4 hours and hourly thereafter for the first 24 hours.

Another enzyme which is very indicative of reperfusion is Myoglobin, which peaks even earlier than CK. Estimation of time activity curve of both these enzymes can be used to estimate the time of recanalisation of occluded artery.

iv) Reperfusion Arrhythmias

Various forms of ventricular arrhythmias have been described as a sign of myocardial reperfusion. Ventricular ectopic beat occurring late in diastole, ventricular bigeminy or trigeminy and occasional fusion beats have all been seen. However almost 50% of the patients exhibit accelerated idioventricular rhythm (AIVR) following reperfusion.

These reperfusion arrhythmias are probably due to increase in automaticity and usually do not require any treatment. Ventricular tachycardia and ventricular fibrillation which by and large are very rare, require prompt treatment.

AV block and intraventricular conduction defect often occur with reperfusion, complete AV block complicating anterior myocardial infarction, on reverting to sinus rhythm after thrombolysis, is accompanied by bradycardia and hypotension which responds well to atropine.

v) Echocardiographic Evaluation

Determination of changes in the regional rather than global ventricular function is now recognized as the proper way to study patients before and after reperfusion. Most studies have shown an improvement in the regional function of the perfused area. Data from 125 patients in the Registry of

European Society of Cardiology indicate an increase in ejection fraction in most patients when treatment was initiated before three hours after the onset of chest pain.

Chia BI, YID et al.[21] reported global LV function improvement in patients with early reperfusion. An increase in EF from 50% from 0 hour to 61% at the end of 7 days was observed. No such changes were seen in patients treated conventionally.

OTHER WAYS OF ASSESSMENT OF MYOCARDIAL SALVAGE

High dose, short-term early IV STK results in early myocardial reperfusion associated with significant improvement in ventricular function. This has been confirmed by the following studies.

1) Contrast ventriculography: Analysing LV regional wall motion and measuring percentage systolic shortening.

2) Thallium 201 perfusion scan showing about 40% reduction in the size of the perfusion defect.

3) Combined Thallium 201 and Technetium 99^{m} Pyrophosphate scintigraphy have been used by Ohsuzu F et al.[22] to assess myocardial salvage.

4) ECG Indices:

a) Gradual increase in the R wave amplitude.

b) Decrease in Q wave during the days following infarction.

5) Positron emission tomography (PET Scan): Showing recovery of aerobic metabolism of ventricular myocardium following myocardial reperfusion.

6) Newer imaging techniques like X-ray computed tomography, Thallium 201 single photon emission computed tomography and MRI – all provide a measure of the extent of myocardial necrosis

Late assessment[14]

1) Treadmill stress test (TMT): TMT using modified Bruce protocol at six weeks revealed an ischemic response in 18% of STK treated patients, while in the control group TMT was positive in 42% of cases.

2) Angiographic evaluation of patency is the fool-proof method of assessing the success or failure of therapy. Earliest sign of reperfusion is the establishment of a sluggish flow of contrast through the vessel. As thrombolysis continues the lumen and the coronary flow generally increase and ultimately this lumen will remain open. However during therapy a cyclic pattern of reperfusion and re-occlusion may occur before substantial reperfusion is achieved. Neither Nitroglycerine nor Calcium channel blockers have been effective in avoiding the intermittency of occlusion.

9. Conjunctive Treatment

Thrombin Antagonists and Antiplatelet Agents

Two major limiting factors for the clinical benefits of thrombolytic therapy are:

1. One fourth to one fifth of the thrombus in coronaries are not thrombolysed

2. One in 10 patients develop re-occlusion of the thrombolyzed vessel

These caused by increased clotting activity at the site of occlusion where the atherosclerotic plaque is present. Thrombin, the main enzyme in the clotting pathway stimulates the fibrin and causes platelet activation and the thrombus is formed. These pro-coagulant cells are activated further by the clotting factors and this leads to vicious cycle leading to thrombus formation and occlusion of the vessel.

The treatment plan involves activating fibrinolysis and inhibit clotting pathway and inhibiting the factors that favour clotting.

Heparin and platelet inhibitors are the main drugs used to inhibit clotting and inhibit platelet aggregation and prevent clot formation. But these drugs may cause

bleeding when used in conjunction with fibrinolysis. Hence highly selective drugs with less complication are needed to prevent resistance to fibrinolysis and re-occlusion.

This is the rationale behind use of antiplatelet drugs in acute STEMI along with fibrinolytic therapy, these drugs inhibit platelet plug formation and also act on the atherosclerotic plaque and stabilises it, and these drugs however in some cases may cause bleeding leading to fatal complication like intra-cerebral haemorrhage.

Combination Therapy

The mechanism of formation of thrombus in a coronary artery clearly justifies the use of combination therapy i.e. anticoagulant and anti-platelet drugs along with fibrinolysis.

The commonly used combination is heparin, aspirin with fibrinolysis shows a benefit and increased efficacy of thrombolysis and prevents re-occlusion of a thrombolysed vessel. Besides the benefit, these drugs cause an increase in the hemorrhagic complications especially when the patient is planned for an invasive procedure like angiogram or PTCA, there are several trials demonstrating both the

beneficial effects of this combination of heparin, aspirin and fibrinolytics and the increased risk of bleeding associated with combination, in GISSI-2 study the hemorrhagic complications are more with the use of streptokinase compared with other fibrinolytic drugs.

ELECTROCARDIOGRAPHY[23]

Myocardial infarction (MI) is reflected electrocardiographically by the electrocardiographic parameters of ischemia, injury and necrosis, are reflected by T wave changes, ST-segment displacement and the appearance of Q waves, respectively.

LOCALIZATION OF INFARCTION[23]

ECG localization of myocardial infarction other than differentiation of anterior from inferior and posterior is at best an approximation of its true anatomical location.

Accuracy is affected, for example by the distance of the electrode from the heart a common variable.

Using the Q-wave as a marker of infarction, one can identify an infarct a

SEPTAL when a Q-wave is present in leads V_1 and V_2, ANTERIOR when it is present in leads V_3 and V_4, ANTEROSEPTAL it present in V_1 to V_4, LATERAL when present in leads I, aVL and V_6. ANTEROLATERAL when present in leads I, aVL and V_1 to V_6, HIGH LATERAL when present in leads I and aVL, INFERIOR when present in leads II, III and aVF, ANTEROINFERIOR TRANSSEPTAL or APICAL when present in leads II, III and aVF and in one or more of leads V_1 to V_4.

A POSTERIOR infarct is recognized by a prominent R-wave in V_1 or V_2 and a POSTEROLATERAL infarct by Q-wave in leads I and aVL and a prominent R-wave in lead V_1 or V_2.

A RIGHT VENTRICULAR INFARCTION (RVI) can be diagnosed by taking Right sided chest leads i.e., V_3R, V_4R, V_5R and V_6R more specific being V_4R. ST-segment elevation of more than or equal to 0.1 mv (1 mm) in atleast one of the right precordial leads stated above, more specific in V_4R is considered an evidence of RVI in patients with acute inferior myocardial infarction. QS-complexes in V_4R and V_3R along with ST-segment elevation, is almost 100% specific diagnostic of RVI in acute myocardial infarction. These changes usually disappears within 10-18 hours after the onset of chest pain in 50% of patients (a transient phenomenon).

ST SEGMENT ELEVATION

(1) Molecular Basis of Electrocardiographic ST-Segment Elevation

Elevation of the ST segment in the electrocardiogram (ECG) is a classical hallmark of acute transmural myocardial ischemia. Indeed, ST elevation is the major clinical criterion for deciding which patients with chest pain require emergent coronary revascularization.

In 1909 Eppinger and Rotenberg[24] observed ST segment elevations in dogs with experimental ventricular injury, and in 1920 Pardee[25] published his description of ST segment elevation as a clinical sign of coronary obstruction. More than 80 years have passed since these observations, yet the exact mechanism is still a subject of debate.

Myocardial cells during the early phase of repolarization carry the same transmembrane potential. Therefore they will not have any net current flow at the time the ST segment is inscribed. ST segment elevation from myocardial ischemia is caused by abnormal current flow (current of injury) between the boundary of normal and ischemic zones.

Various studies have suggested that activation of sarcolemmal ATP-sensitive potassium (KATP) channels by ischemic ATP depletion may play a role, but little direct evidence is available.

Li et al.[26] studied mice with homozygous knockout of the Kir 6.2 gene, which encodes the pore-forming unit of cardiac KATP channels. In the presence of left anterior descending artery ligation, while the ST segment elevation was evident in normal mice the elevation was absent in those with the knockout, supporting the concept that the KATP channels are responsible for ST segment elevation.

Mechanistically, ischemia leads to an increase of extracellular K1 with membrane depolarization, depletion of intracellular ATP, and action potential shortening. Together, these cellular events lead to electrical inhomogeneity within the heart, generating injury currents between ischemic and normal cells and shifting the ST segment in the ECG.

(2) ST Segment Elevation Resolution after Thrombolytic Therapy

The ST segment was measured 80 ms after the J point. The summed ST segment elevation was measured by summing the ST amplitude in all leads with ST elevation at baseline (before fibrinolysis) and at 90 minutes (postfibrinolysis), using methods described by Schroder and colleagues.[27]

The per cent resolution of STR was calculated as the initial sum of ST segment elevation minus the sum of ST segment elevation on the second ECG, divided by the initial sum of ST segment elevation.

Three categories of resolution have been proposed and validated prospectives:

Category 1: < 30%, resolution of the sum of ST-segment elevation

Category 2: ≥ 30 but < 70%, resolution of the sum of ST-segment elevation

Category 3: ≥ 70% resolution of the sum of ST-segment elevation

These three categories were shown to be prognostically important at 3 hours after the initiation of thrombolytic therapy.

(3) Prognostic importance of ST segment resolution after thrombolysis in acute myocardial infarction

Resolution of ST segment elevation has been shown to be a simple and useful predictor of final infarct size, left ventricular function, and clinical outcome after both thrombolytic and interventional approaches to the management of acute myocardial infarction.

The primary goal of reperfusion therapy has shifted from opening of the infarct related artery to establishment of myocardial tissue perfusion.It has been reported that STR is a practical and useful measure of this latter variable.

The gold standard test for the success or failure of thrombolytic therapy is considered to be coronary angiography.

However, such an examination represents a "snapshot" of the coronary epicardial tree at a given moment, and cannot describe the dynamic changes that take place over time in the infarct-related artery and the myocardium supplied by the artery.

A number of studies compared the prognostic value of STR with coronary angiography results after thrombolytic therapy.

De Lemos et al.[28] observed that patients with complete(>70%) STR from baseline at 90 minutes had a 94% probability of IRA patency (TIMI-2 or 3), a TIMI-3 flow rate of 79%, and 30 day cardiac mortality as low as 1%.

Patients with partial (30±70%) STR had 72% patent IRA and a TIMI-3 flow rate of 50%. Thirty day mortality in this group was 4.2%.

Cases with no (<30%) STR presented with 68% patent IRA and 44% TIMI-3 flow rate, while the 30 day mortality was 5.9%.

Other studies, such as GISSI,[11] found that two-thirds of the patients had complete (>50%) STR 4 hours after thrombolysis, and 30 day cardiac mortality of 3.5% versus 5.7% in those without resolution.

Schroder et al.[27] studied the prognostic power of early STR 3 hours after the start of thrombolysis in patients recruited in the Intravenous Streptokinase in Myocardial Infarction Study.

Complete (>70%) resolution was observed in 45%, partial resolution (70 ± 30%) in 31% and no resolution in 24%.

For the three groups, infarct size (measured by CK-MB percent release), echocardiographic left ventricular ejection fraction 1 month after the event, and mortality rates at 21 days (2.2%, 3.4%, and 8.6%) were assessed.

The authors concluded that no STR was the most powerful independent predictor of early mortality.

Neuhaus KL et al.[29] found in the study that simple measurements of ST segment deviation existing in the one ECG lead with greatest deviation on ECG 90/180 min after thrombolysis enables the identification of the major subsets of patients who are either at very low or exceptionally high risk of mortality.

Schroder K et al.[30] found that persistent ST elevation may be due to microvascular damage impeding myocardial blood supply.

Poor recovery of left ventricular function after ischemic myocardial injury may cause increase in mortality. Sum of ST segment resolution may be used for assessing infarct size, left ventricular function, epicardial vessel patency and mortality

It is worth mentioning here the results of research in which STR was studied after primary percutaneous transluminal coronary angioplasty.

In the Zwolle Angioplasty Study,[31] all patients attained patent IRA with TIMI-3 flow, yet complete (>70%) STR was seen in 51% patients, partial (30±70%) in 34%, and 15% had no (<30%) STR.

Matetzky et al.[32] examined the STR of 117 patients after successful (TIMI-3 flow) angioplastic reperfusion for acute myocardial infarction. Seventy-six percent of the patients had complete (>50%) STR while 24% did not.

The group of patients without STR was associated with high in-hospital (11% vs. 2%) and long-term mortality (21% vs. 12%), as well as with worse pre-discharge and late left ventricular ejection fraction.

Such results support the theory that myocardial reperfusion requires patent IRA and an intact microvascular bed, and that STR is a marker of myocardial reperfusion and not just of coronary artery patency.

Several investigators recently reported that persistent ST segment elevation is predictive of poor ventricular recovery and mortality. Andrews and co-workers demonstrated that patients with complete (>50%) STR and TIMI-2 or 3 on angiography presented with improved wall motion 48 hours after thrombolytic therapy, while those without STR had worse wall motion.

Van't Hof,[3] Somitsu[33] and Santoro[34] and their teams reached comparable conclusions, and the hypothesis was supported by results from contrast echocardiography[35] and nuclear scintigraphy.[36]

The large majority of studies defined success or failure of thrombolysis based on ST deviation analysis at 90 minutes from the start of therapy.

The main principle was to reserve sufficient time for an invasive intervention if fibrinolysis was unsuccessful, in order to generate reflow to the jeopardized myocardium

In the HIT-4 substudy[37] mentioned earlier, Schroder et al. compared the prognostic value of STR at 90 and 180 minutes after the start of thrombolytic therapy.

Complete STR at 180 minutes identified 50% of the patients with a 30 day cardiac mortality less than 2% and was the most powerful independent predictor of early cardiac mortality in multivariate analysis.

While mortality rates doubled at 180 minutes, the proportion of patients with no STR decreased by two-thirds from 90 to 180 minutes.

Those observations are consistent with recanalization of IRA later than 90 minutes after the start of streptokinase therapy.

In contrast, de Lemos et al.[28] reported that patients with complete, versus those without STR at 60 minutes are likely to present with even lower risk for mortality and congestive heart failure.

Nonetheless, such an early analysis will facilitate a more rapid decision about rescue PTCA,

Been M et al. found that rapid reduction of ST elevation will be predicted by relief from chest pain, early peaking of serum concentration of CK, reperfusion arrhythmia.

Another point of controversy between two aspects of STR is continuous versus "snapshot" ST segment monitoring.

Shah et al demonstrated that a rapid and stable STR pattern was an independent predictor for combined mortality or congestive heart failure.

METHODOLOGY

SOURCE OF DATA

All patients with diagnosis of acute ST segment elevation according to ACC/AHA guidelines 1999,[10] admitted to Thanjavur Medical college during period from " December 2013 to August 2014".

METHOD OF COLLECTION OF DATA

Sample size: Minimum of 60 cases of diagnosed ST segment elevation myocardial infarction.

Sampling method: Simple random sampling

INCLUSION CRITERIA

All the patients with first attack of ST segment elevation myocardial infarction diagnosed according to ACC/AHA guidelines 1999[10] without any conventional contraindications for thrombolysis before 12 hours of onset of symptoms.

EXCLUSION CRITERIA

- Patients with previous history of acute myocardial infarction patients coming to hospital after 12 hours of onset of symptoms.

- Patients with conventional contraindications for thrombolytic therapy.

- Patients with previous history of valvular heart disease, cardiomyopathies and congenital heart disease.

- If patient dies before 90 minutes after thrombolytic therapy

- Bundle branch block

Data will be collected in a pre-tested proforma by meeting objectives of study, detailed history, physical examination; thorough cardiovascular and other systems examination and necessary investigations are recorded.

A 16 lead ECG consisting of 12 conventional leads and 4 right sided chest leads was recorded at the time of admission, 90 minutes after the thrombolysis everyday subsequently for 7 days. Standard lead II was cased to monitor and record rhythm disturbances.

ECG's were recorded on **"Bionet Cardio Care 2000 Machine"** with 3 channel and 1 rhythm and other standard settings 1mV = 10mm and 25mm/sec

Patients monitored on Philips Heart Start XL cardiac monitor cum Biphasic Defibrillator

The other routine investigations to which patients were subjected are as follows:

Hb%

TC

DC

ESR

Urine: Albumin

Sugar

Microscopy

Lipid profile within 24 hours of onset of chest pain

FBS, PPBS whenever necessary

B. urea

S creatinine

S. electrolytes

CKMB

Trop T

Chest X-ray PA view (whenever necessary)

ST segment was measured 80 millisec after the J point. The summed ST segment elevation was measured by summing the ST segment amplitude in all leads.

With ST elevation at base line ECG (before thrombolysis) and at 90 min ECG (post thrombolysis) using methods described by Schroder et al.[27]

The percent resolution of ST segment resolution was calculated as the sum of ST segment elevation on first ECG minus the sum of ST segment elevation on second ECG, decided by initial sum of ST segment elevation.

Based on values obtained, study population divided into three categories: A, B and C.

A. Category A: < 30% resolution of the sum of ST segment elevation.

B. Category B: 30% - 70% resolution of the sum of ST segment elevation.

C. Category C: > 70% resolution of the sum of ST segment elevation.

Clinical details were recorded prospectively. In hospital, major adverse events were defined as the occurrence of any of the following. Killip Class II–IV, Left ventricular failure, cardiogenic shock, recurrent angina, significant arrhythmias (which needs definite pharmacological, DC cardioversion and interventions like pacing) and death.

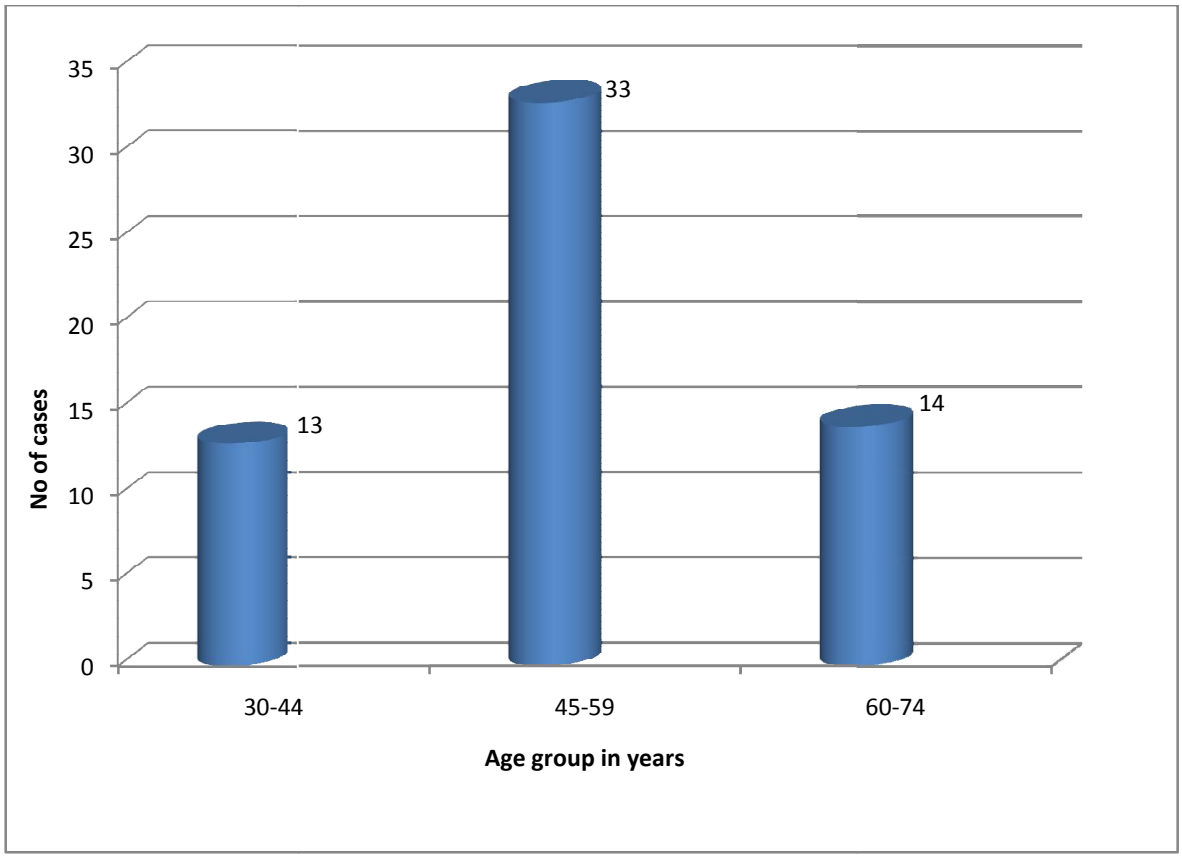
Adverse events were divided according to timing < 48 hours after admission and > 48 hours after admission. An uncomplicated course was defined as no major adverse event during entire inpatient stay.

RESULTS

Table 1: Age distribution of patients

Age group (years)	Number of cases	Percentage	p-value
30-40	13	21.7	0.002
40-59	33	55.0	
60-74	14	23.3	

Figure 3: Age distribution of patients

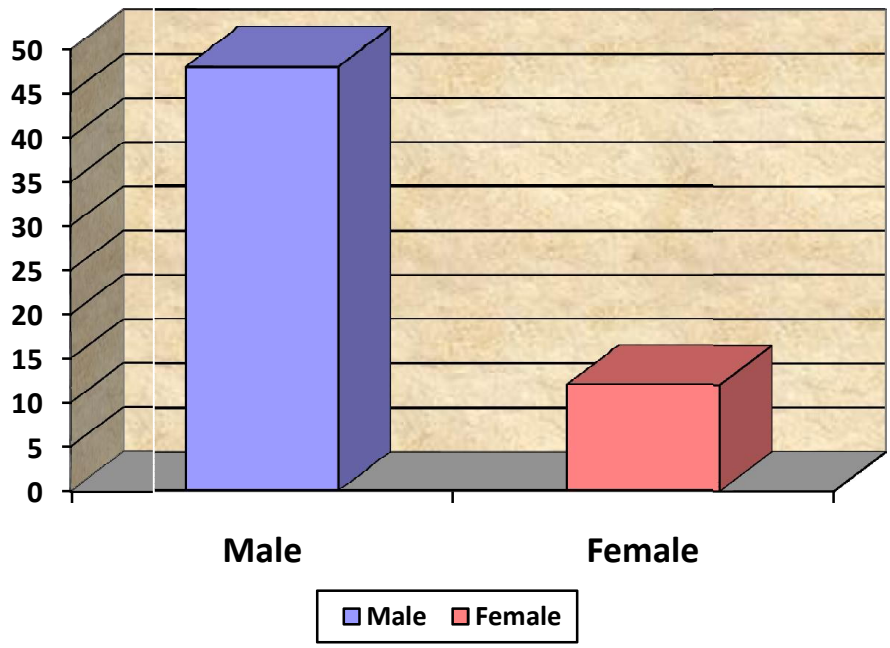


In the present study, the minimum age of the patient is 30 years, maximum age 72 years. Maximum numbers of patients in between 40-59 years constitute 55%. Mean age of present study is 50.7 ± 9.6.

Table 2: Sex distribution

	Number of cases	Percentage	p-value
Male	48	80	0.000
Female	12	20	

Figure 4: Sex distribution



In this study sex distribution shows a clear male preponderance.

Table 3a: Age-Sex cross tabulation

Age group (years)	Number of cases in males	Number of cases in females
30-44	12 (25%)	1 (8.3%)
45-59	26 (54.2%)	7 (58.3%)
60-74	16 (20.8%)	4 (33.3%)

Figure 5: Age sex Cross tabulation

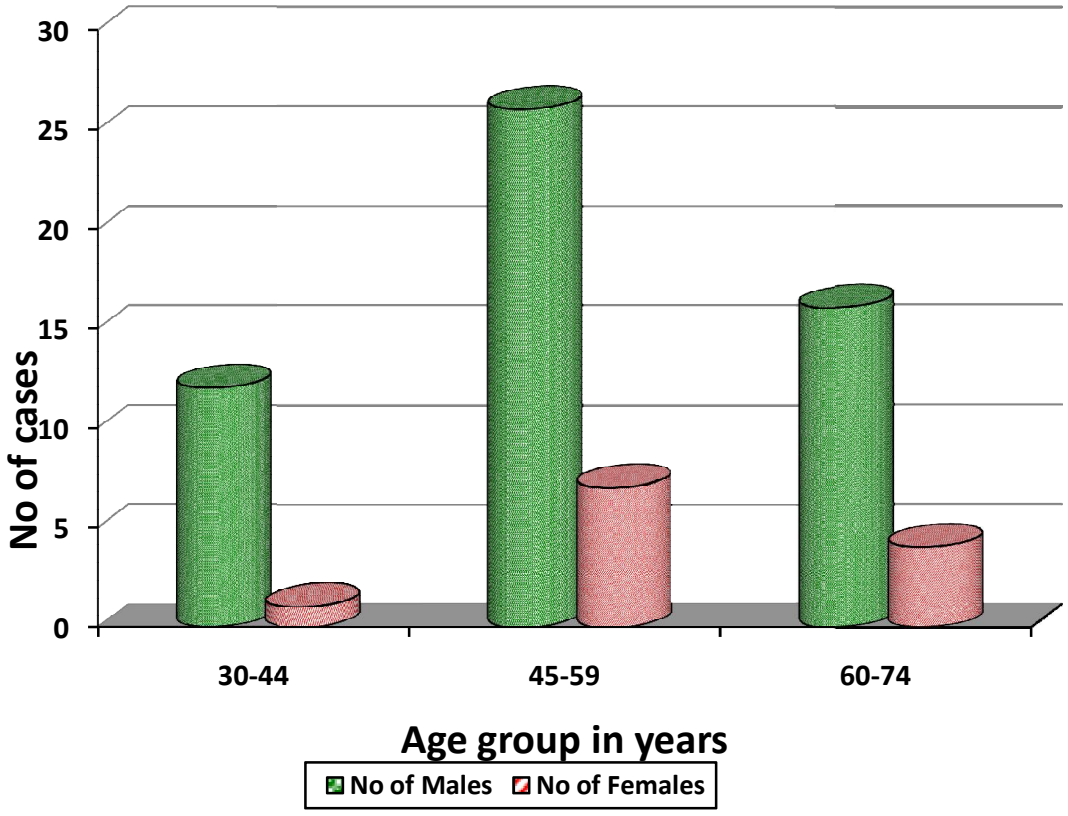
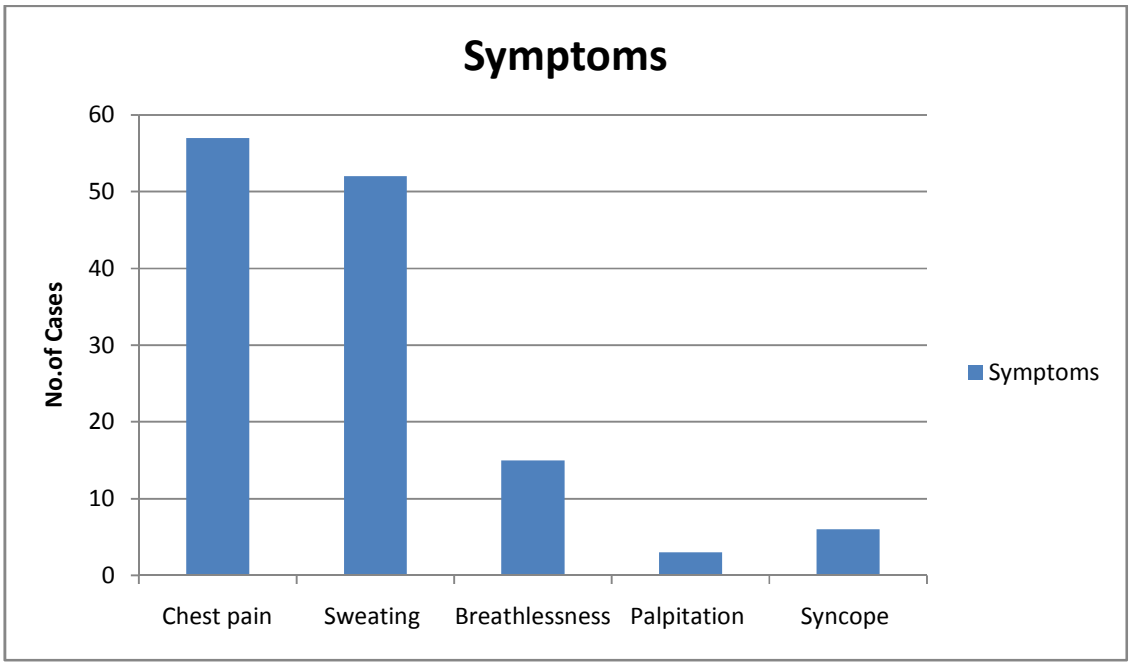


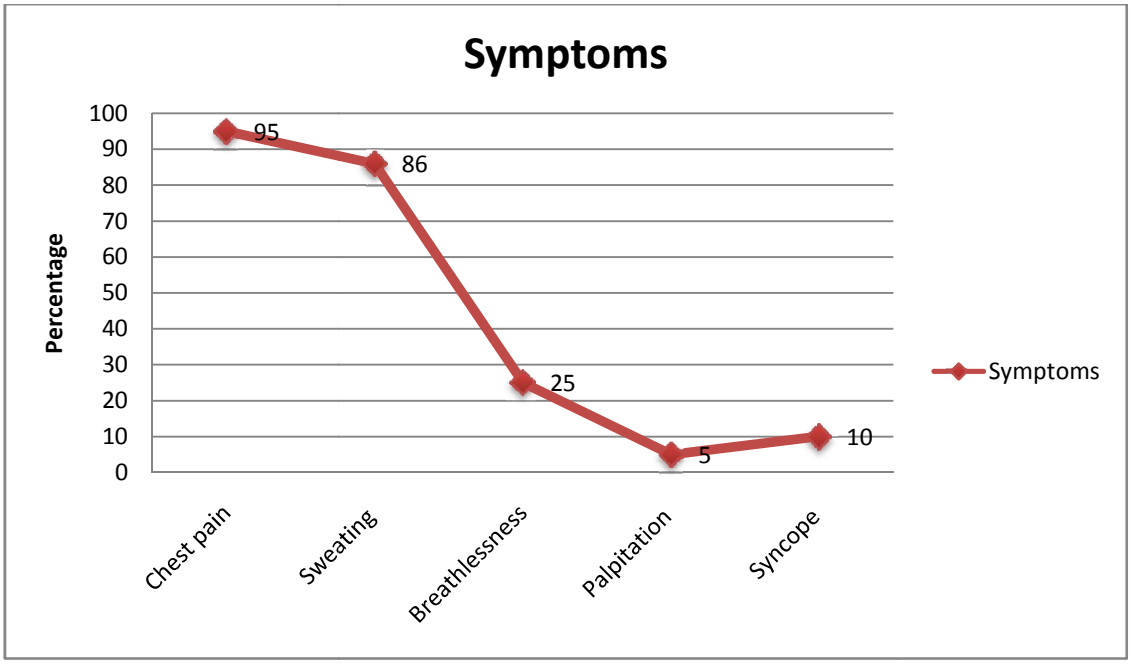
Table 3b : Symptoms at presentation

Symptoms	Number of cases	Percentage	p-value
Chest pain	57	95	0.0000
Sweating	52	86	0.0000
Breathlessness	15	25	0.0000
Palpitation	3	5	0.0000
Syncope	6	10	0.0000

In this study chest pain was the most common mode of presentation, present in 57 patients associated with sweating in 52 patients, breathlessness seen in 15 patients. Syncope was seen in 6 patients and palpitation in 3 patients.

Figure 6: Symptoms at presentation



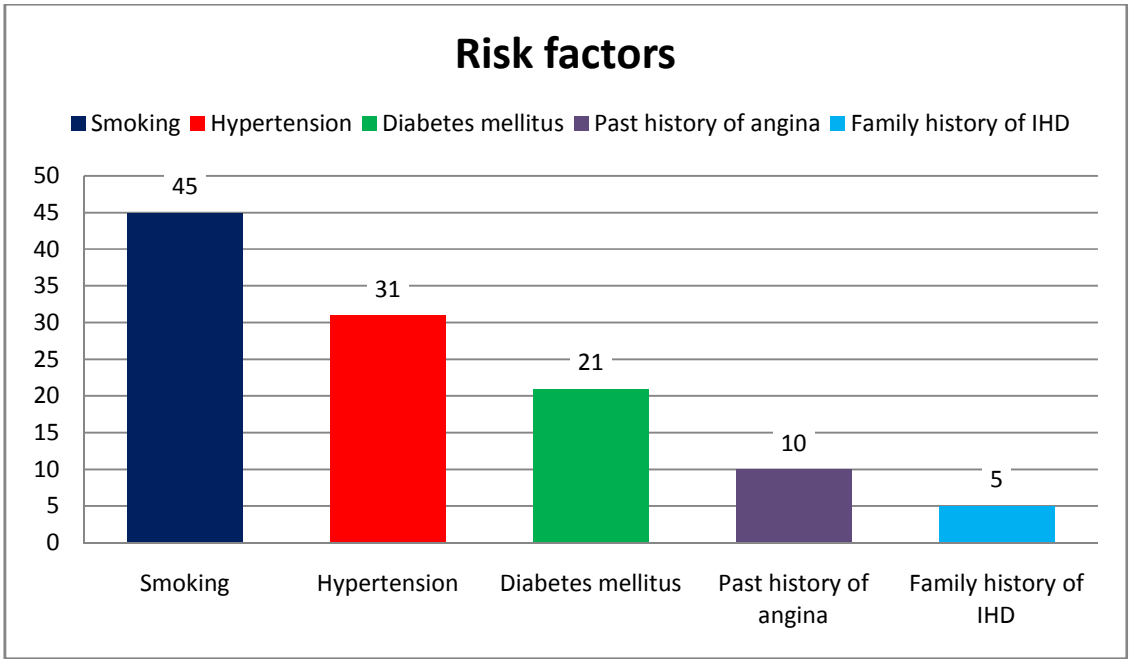


In this study chest pain was the most common mode of presentation, present in 95% cases associated with sweating in 86% cases, breathlessness seen in 25% cases. Syncope was seen in 10% cases and palpitation in 5% cases.

Table 4: Risk factors

Risk factors	Number of cases	Percentage	p-value
Smoking	45	75	0.000
Hypertension	31	51.7	0.796
Diabetes mellitus	21	35	0.020
Past history of angina	10	16	0.000
Family history of IHD	5	8	0.000

Figure 7: Risk factors



In the present study smoking is seen in 75% cases, hypertension is seen in 51.7%, Diabetes mellitus is seen in 35% cases, past history of angina seen in 16% cases and family history of IHD is seen in 8%.

Table 5: Type of Infarction

Type of infarction	Number of cases	Percentage	p-value
Anterior wall	35	58.3	0.197
Inferior wall	25	41.7	

Figure 8: Type of infarction

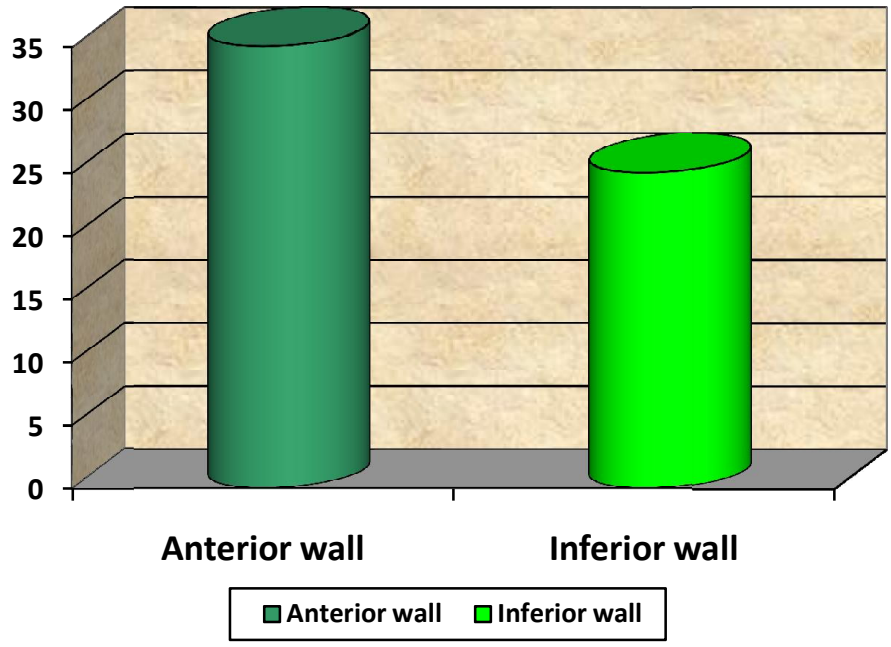
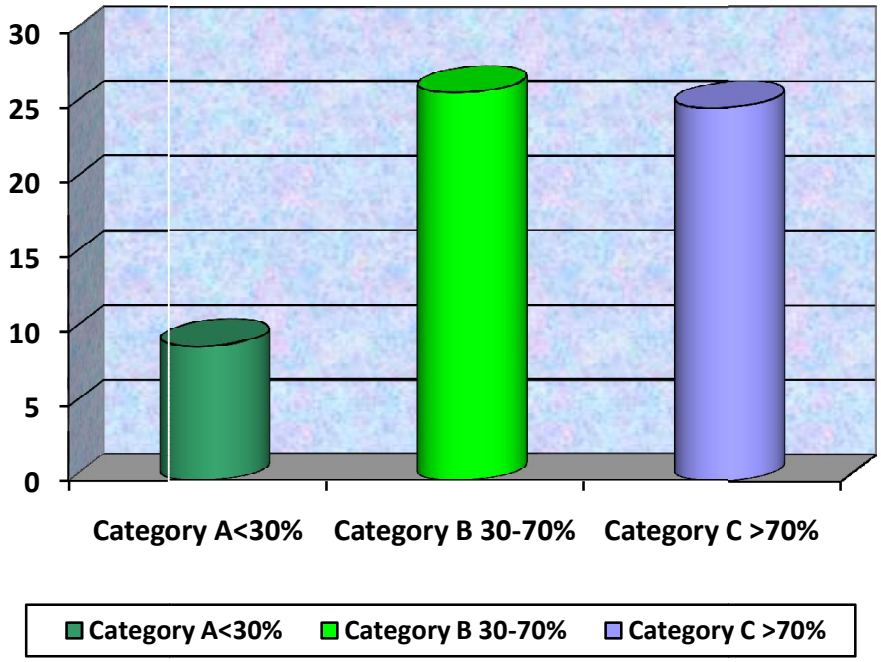


Table 6: ST segment resolution 90 minutes after thrombolysis

ST segment resolution	Number of cases	Percentage	p-value
Category A <30%	9	15	0.000
Category B 30-70%	26	43.3	0.302
Category C >70	25	41.7	0.197

Figure 9: ST segment resolution 90 minutes after thrombolysis

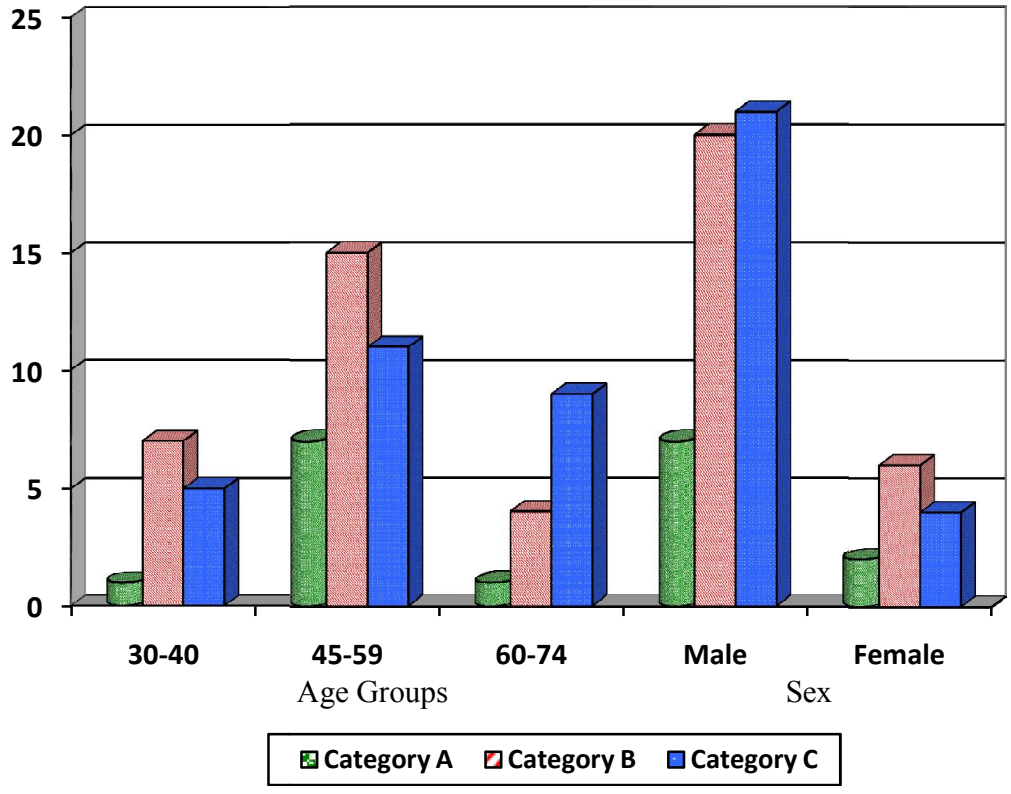


Complete ST resolution seen among 41.7% cases, partial resolution seen among 43.3% and no resolution among 15% cases.

Table 7: Base line characteristics in ST segment resolution subgroups

		Categories		
		A	**B**	**C**
Age group (years)	30-40	1 (11.1%)	7 (26.9%)	5 (20%)
	45 – 59	7 (77.8%)	15 (57.7%)	11 (44%)
	60 – 74	1 (11.1%)	4 (15.4%)	9 (36%)
Sex	Male	7 (77.8%)	20 (76.9%)	21 (84%)
	Female	2 (22.2%)	6 (23.1%)	4 (16%)

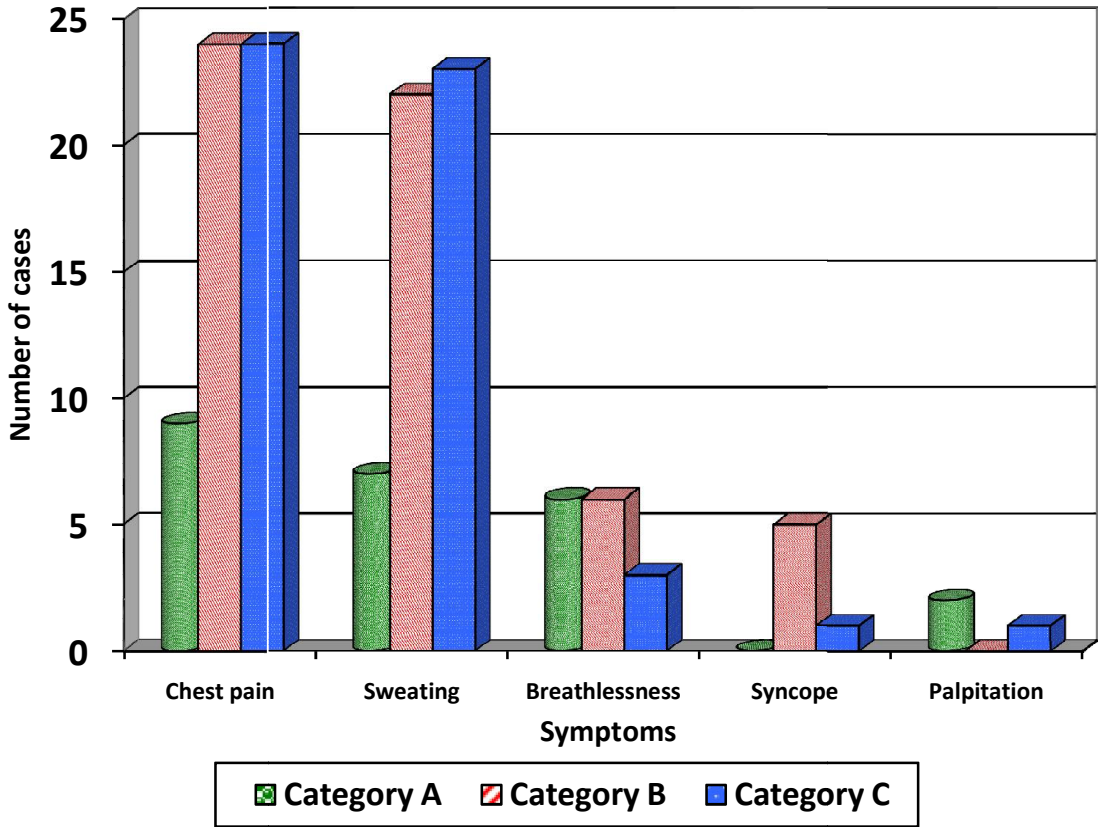
Figure 10: Base line characteristics in ST segment resolution subgroups



Presenting Symptoms in each group

Symptoms	Categories		
	A	B	C
Chest pain	9 (100%)	24 (92.3%)	24 (96%)
Sweating	7 (77.8%)	22 (84.6%)	23 (92%)
Breathlessness	6 (66%) P=0.002	6 (23.1%)	3 (12%) P=0.049
Syncope	0	5 (19.2%) P=0.03	1 (4%)
Palpitation	2 (22.2%) P=0.010	0	1 (4%)

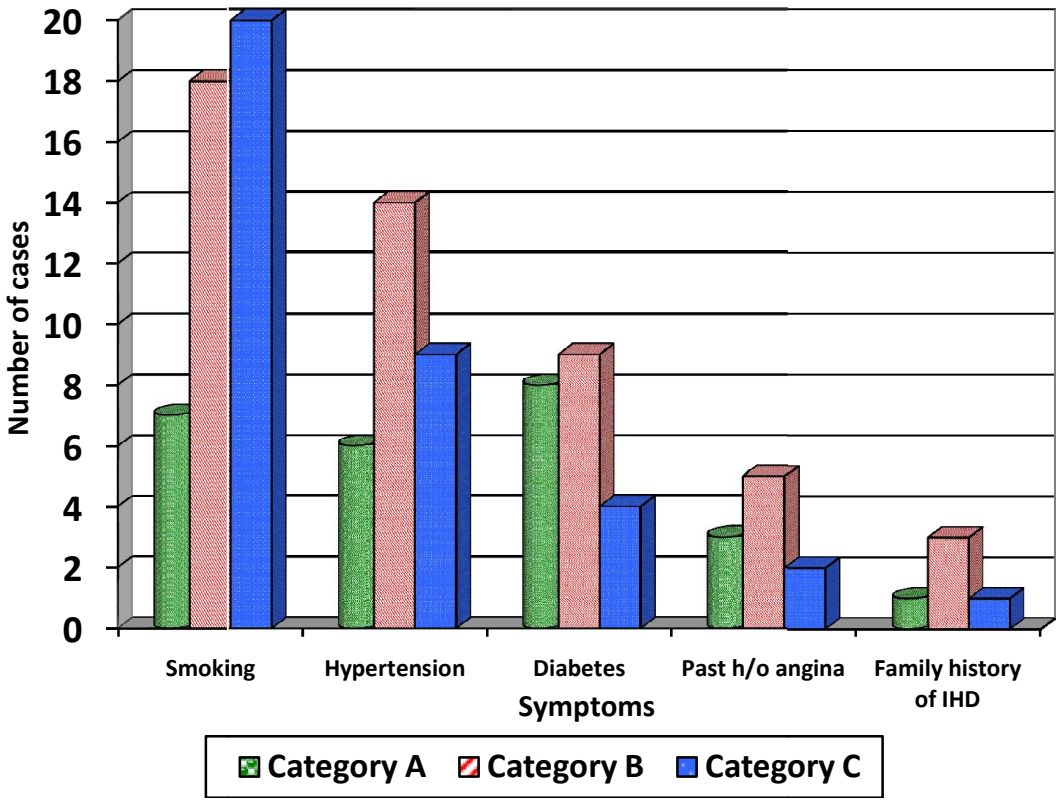
Figure 11: Symptoms



Risk Factors in each group

	Categories		
	A	**B**	**C**
Smoking	7 (77.8%)	18 (69.2%)	20 (80%)
Hypertension	6 (66.7%)	14 (53.8%)	9 (36.0%)
Diabetes mellitus	8 (88.9%)	9 (34.6%)	4 (16%)
Past history of angina	3 (33.3%)	5 (19.2%)	2 (8%)
Family history of IHD	1 (11.1%)	3 (11%)	1 (4%)

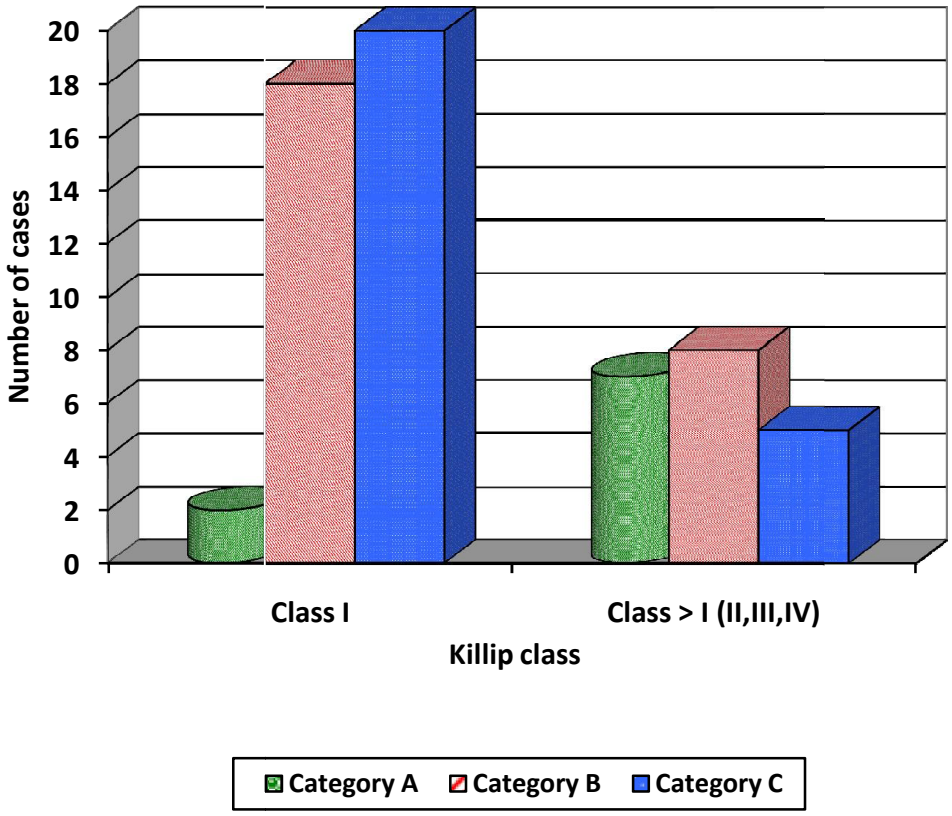
Figure 12: Risk factors



Killip Class

	Categories		
	A	**B**	**C**
Class I	2 (5%)	18 (45%)	20 (50%)
Class > I (II, III, IV)	7 (35%)	8 (40%)	5 (25%)
p-value	0.000	0.507	0.117

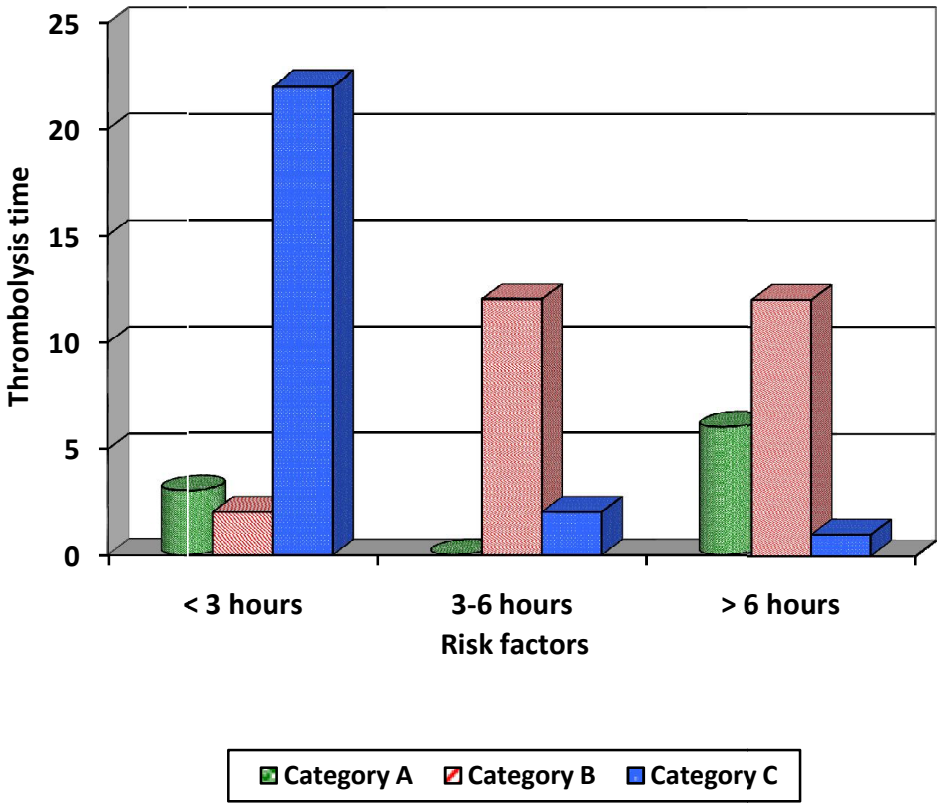
Figure 13: Killip Class



Symptom Onset to Thrombolysis Time

Thrombolysis time	Categories		
	A	B	C
< 3 hours	3	2	22
3–5 hours	0	12	2
> 5 hours	6	12	1
p-value	0.032	0.000	0.000

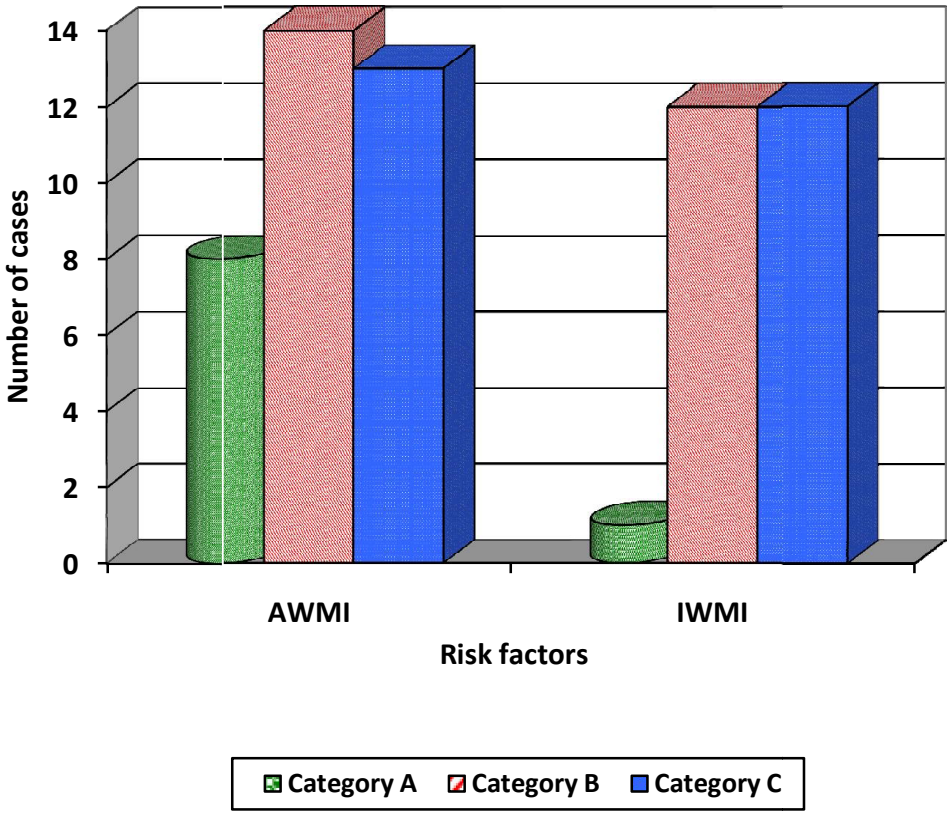
Figure 14: Symptom Onset to Thrombolysis Time



Type of Myocardial Infarction

	Categories		
	A	**B**	**C**
Anterior wall myocardial infarction	8 (88.9%)	14 (53.8%)	13 (52%)
Inferior wall myocardial infarction	1 (11.1%)	12 (46.2%)	12 (48%)
p-value	0.04	0.53	0.4

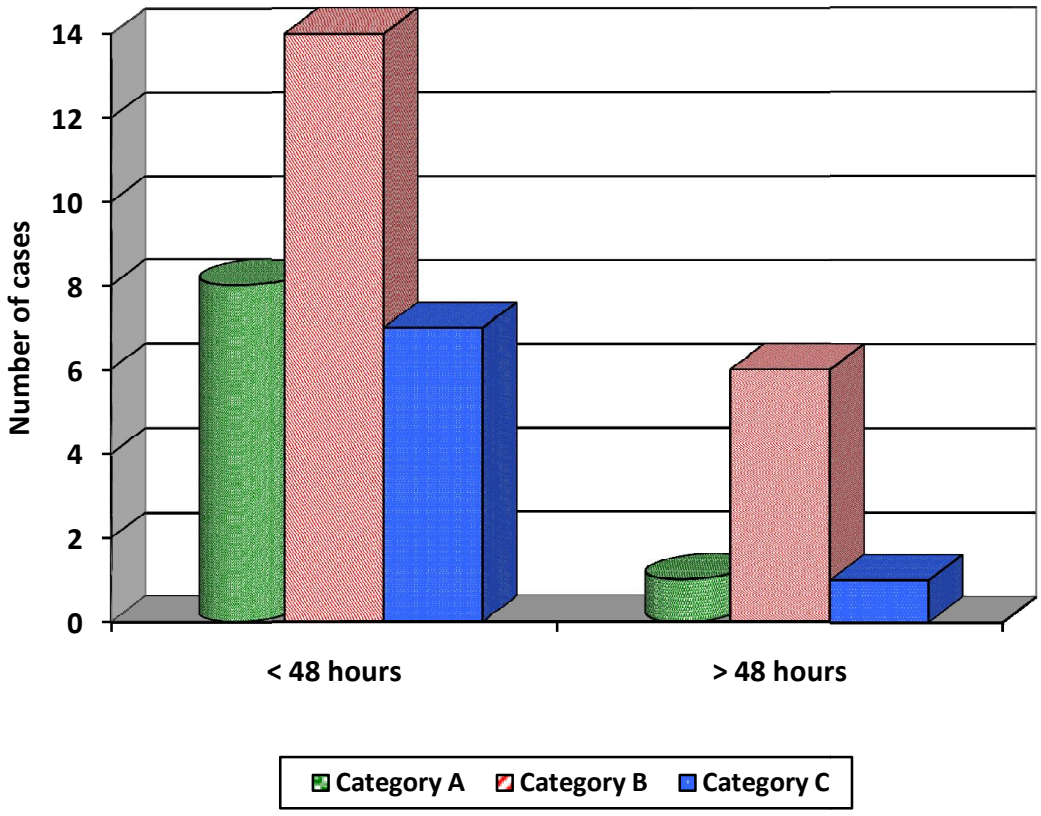
Figure 15: Type of Myocardial Infarction



Onset of adverse Events

	Categories		
	A	**B**	**C**
< 48 hours	8 (88.9%) p=0.008	14(53.8)% p=0.455	7 (28%) p=0.08
> 48 hours	1 (11.1%) p=0.832	6 (23.1%) p=0.052	1 (47%) p=0.072

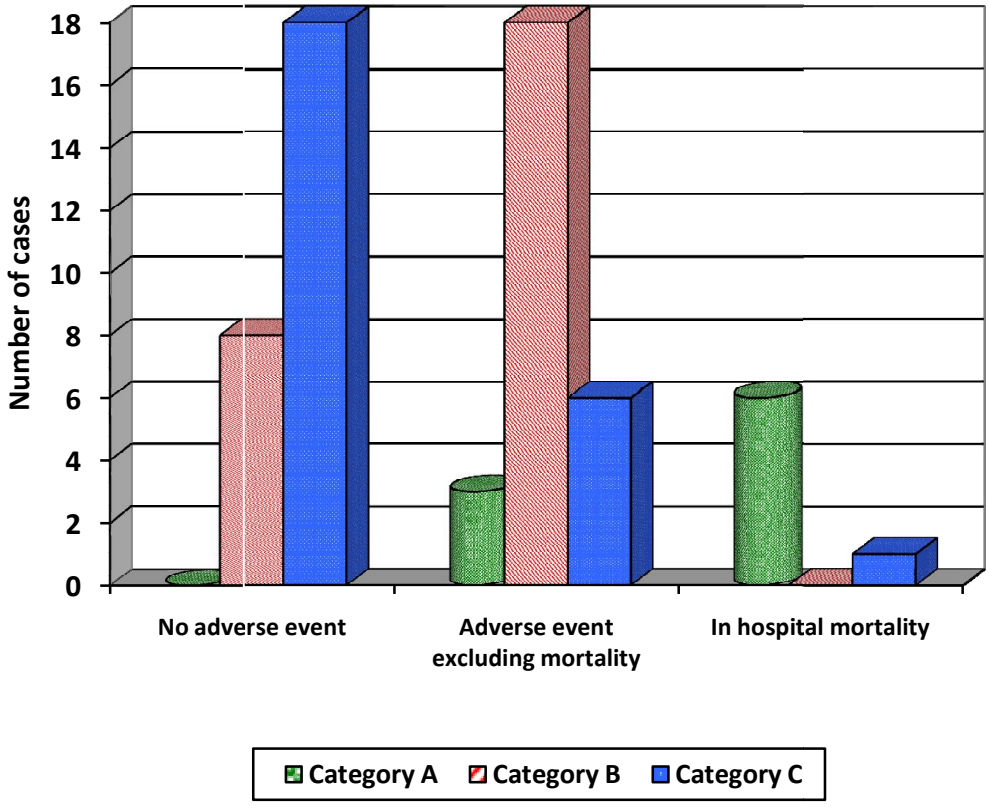
Figure 16: Onset of adverse events



Outcome

	Categories		
	A	**B**	**C**
No adverse event	0 P=0.000	8 (30.8%)	18 (72%) P=0.000
Adverse event excluding in-hospital mortality	3 (33.3%) P=0.445	18 (69.2%) P=0.001	6 (24%) P=0.006
In-hospital mortality	6 (66.7%) P=0.000	0 P=0.014	1 (4%)

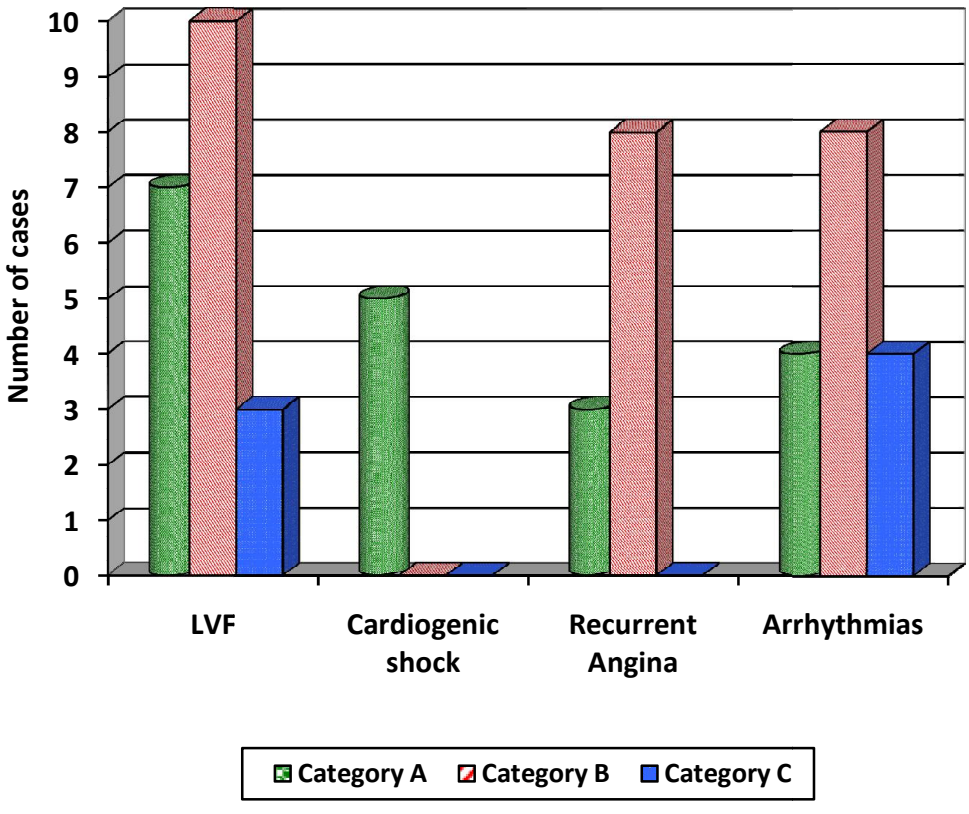
Figure 17: Outcome



Type of adverse outcome

	Categories		
	A	**B**	**C**
LVF	7 (77.8%) p=0.002	10 (38.5%) p=0.461	3 (12%) p=0.003
Cardiogenic shock	5 (55.6%) p=0.000	0 p=0.029	0 p=0.002
Recurrent Angina	3 (33.3%) p=0.207	8 (30.8%) p=0.029	0 p=0.002
Arrhythmias	4 (44.4%) p=0.191	8 (30.8%) p=0.530	4 (16%) p=0.114

Figure 18: Type of adverse event



Inhospital mortality

Categories					
A		**B**		**C**	
No.	**%**	**No.**	**%**	**No.**	**%**
6	66.7%	0	0	1	4%
p=0.000		p=0.014		p=0.118	

Cause of death

	Number	**Percentage**
Cardiogenic shock	5	71.4%
VT / VF	2	28.6%

DISCUSSION

The present study documents the usefulness of the standard electro-cardiographic ST segment resolution after 90 min following thrombolytic therapy as a predictor of coronary artery reperfusion.

Table 8: Age incidence among different studies

Studies	Number of cases	Year	Mean age
Schroder et al.[27]	1398	1995	60.9 ± 12
French et al.[39]	869	2001	55.5 ± 9.7
Zeymer U et al.[40]	761	2001	60.9 ± 11
Dong et al.[41]	121	2002	60 ± 11
Bhatial et al.[42]	85	2004	62.7 ± 12
Sezer, Nasanci, Umman et al.[43]	33	2004	58.2 ± 11.2
Present study	60	2014	50.7 ± 9.6

In present study the mean age of patient is 50.7 years compared to other studies in present study mean age of population is 10 years younger.

Table 9: Sex incidence among different studies

Authors	Number of cases	Year	Male (%)	Female (%)
Schroder et al.[27]	1398	1995	76%	24%
French et al.[39]	869	2001	80%	20%
Zeymer U et al.[40]	761	2001	76.71%	23.3%
Dong et al.[41]	121	2002	80%	20%
Bhatial et al.[42]	85	2004	69%	31%
Sezer, Nasanci, Umman et al.[43]	33	2004	70%	30%
Present study	60	2014	80%	20%

In the present study, there is a male preponderance. There is similar male preponderance in different study groups.

Table 10: Risk factors among different studies

Risk factors	French et al.[39] (2001) (N = 869)	Zeymer U et al.[40] (2001) (N = 761)	Dong et al.[41] (2002) (N = 121)	Bhatial et al.[42] (2004) (N = 85)	Present study (2014) (N = 60)
Smoking	43%	45.5%	48%	39.5%	75%
Hypertension	27%	37.8%	63%	45.5%	51%
Diabetes	9%	13.1%	20%	24%	35%
Prior angina	23%	-	-	25%	16%

In present study smoking is single most common risk factor, followed by hypertension and diabetes. Percentages of smokers are high compared to other studies. Percentage of diabetes high also when compare to other studies.

Table 11: Baseline variable among ST resolution sub groups (Complete resolution group: > 70% resolution)

	Schroder et al.,[27] 1995 (n=1398)	French et al.,[39] 2001 (n=869)	Dong et al.,[40] 2002 (n=121)	Anderson et al.,[44] 2002 (n=2352)	Present study, 2014 (n=60)
Percentage of cases	49%	38.25%	38.11%	44%	41.7%
Mean age	60.9	57.8	60	63	53.00±10
Female	24%	20%	22%	30%	20%
Smoking	42%	44%	48%	42%	80%
Hypertension	30%	27%	53%	39%	36%
Diabetes	10%	8%	12%	13%	16%
Anterior wall	33%	-	20%	39%	52%
Inferior wall	77%	-	80%	61%	48%
Mean time of onset of symptoms to initiation of treatment (hours)	-	2.8 ± 1.1	3.7 ± 2	2.9	2.81±0.95
Killip class > I	10%	-	8%	-	20%

Base line variables in complete resolution group similar to other study groups, except for age and smoking. Patients in the present study are 10 years younger compared to other study groups. Percentage of smokers among population group of present study almost doubles that of other study groups.

Table 12: Baseline variable among ST resolution sub groups (Partial resolution group 30 – 70%)

	Schroder et al.,[27] 1995 (n=1398)	**French et al.,[39] 2001 (n=869)**	**Dong et al.,[40] 2002 (n=121)**	**Anderson et al.,[44] 2002 (n=2352)**	**Present study, 2014 (n=60)**
Percentage of cases	30%	31%	35.87%	29%	43.3%
Mean age	61.6	56.9 ± 9.6	61 ± 14	62	52.4±8.7
Female	26%	23%	20%	22%	23%
Smoking	-	41%	49%	44%	69.2%
Hypertension	-	26%	52%	40%	53.8%
Diabetes	16%	8%	22%	13%	34.6%
Anterior wall	62%	-	47%	56%	53.8%
Inferior wall	38%	-	53%	44%	46.2%
Time of treatment (hours)	-	2.8 ± 1.3	4.4 ± 2.8	2.9	5.0±1.22
Killip class > I	14%	-	7%	-	30.7%

Majority of baseline variables in partial resolution group similar with different study groups. But mean age of present population group is at least 10 years younger compared to other studies. Percentage of smokers and diabetes are more in present population group when compared to other study groups.

Table 13: Baseline variable among ST resolution sub groups (No of resolution group < 30%)

	Schroder et al.,[27] 1995 (n=1398)	French et al.,[39] 2001 (n=869)	Dong et al.,[40] 2002 (n=121)	Anderson et al.,[44] 2002 (n=2352)	Present study, 2014 (n=60)
Percentage of cases	21%	30.6%	34.97%	26%	15%
Mean age	62.8	58.3 ± 9.2	60	63	50.77±10.2
Female	27%	20%	17%	25%	22.22%
Smoking	-	43%	40%	41%	77.8%
Hypertension	-	27%	63%	44%	66.7%
Diabetes	22%	11%	19%	16%	88.9%
Anterior wall	58%	-	62%	56%	88%
Inferior wall	42%	-	38%	44%	12%
Time of treatment (hours)	-	2.8 ± 1.1	4.5 ± 2.8	2.8	5.2±2.00
Killip class > I	34%	-	26%	-	77.77%

When compared to other study groups.. Diabetes is most frequent risk factor followed by smoking and hypertension. Percentage of risk factors are high when compare to other study groups. Ratio of anterior wall myocardial infarction to inferior wall MI very high when compared to other study groups. Mean time of onset of symptoms to treatment also high in present study compared to other study groups.

Table 14: Adverse events in such groups (complete resolution group) and inhospital mortality

	Schroder et al.,[27] 1999 (n=1398)	**Anderson et al.,[44] 2002 (n=2352)**	**Present study, 2014 (n=-60)**
LVF	13%	13.9%	12%
Cardiogenic shock	2.6%	2.2%	0
Arrhythmias	13%	NA	16%
Recurrent angina	13%	3.4%	0
Inhospital mortality	4%	3.2%	4%

Adverse events in complete resolution group in the present study are similar to other study groups. Arrhythmias are most frequent adverse events. In the present study group which can be comparable to other study groups. followed by left ventricular failure. In hospital mortality is 4% in present study which is similar to other study groups.

Table 15: Adverse events in such groups (partial resolution group) and inhospital mortality

Partial resolution group	Schroder et al.,[27] 1995 (n=1398)	Anderson et al.,[44] 2002 (n=2352)	Present study, 2014 (n=60)
LVF	20%	18.9%	38.5%
Cardiogenic shock	3.8%	3.1%	0
Arrhythmias	15%	NA	30.8%
Recurrent angina	183%	2.7%	30.8%
Inhospital mortality	2%	6.6%	0

Most common adverse event in partial resolution group in the present study is left ventricular failure followed by arrhythmias and recurrent angina, which is comparable to other study groups. However percentages of adverse events are higher in the present study compare to other study group.

Table 16: Adverse events in such groups (no resolution group) and in hospital mortality

No resolution group	Schroder et al.,[27] 1995 (n=1398)	Anderson et al.,[44] 2002 (n=2352)	Present study, 2014 (n=60)
LVF	32%	23.3%	77%
Cardiogenic shock	17%	6.7%	55%
Arrhythmias	24%	NA	44.4%
Recurrent angina	14%	40%	33.3%
Inhospital mortality	18%	6.6%	66.7%

Most frequent adverse event in no resolution group in the present study, LVF followed by cardiogenic shock. Even in other study groups LVF is the most frequent adverse event. But percentages of adverse events in the present study group are higher compare to other study groups. In hospital mortality in the present study group is 66.7% which is also high when compared to other study groups.

SUMMARY

- This study is a prospective study with sample size of 60 patients admitted to IMCU, Thanjavur Medical college Hospital, during the period from December 2013- August 2014

- Mean age of population studied is 50.7 ± 9.6.

- Male to female ratio 4:1 shows a clear male preponderance.

- Chest pain the is most common mode of presentation seen in 95% of cases, followed by sweating and breathlessness.

- Smoking is the most common risk in the present study, followed by hypertension and diabetes respectively.

- Anterior wall MI constitutes 58.3% compared to inferior wall MI 41.7%.

- Based on percentage of ST segment resolution after 90 minutes of thrombolysis. Patients divided into three categories. Patients with > 70% ST resolution (complete STR) constitute 41.7%, patients with 30-70% ST resolution (partial STR) constitutes 43.3%, patients with < 30% ST resolution (no STR) constitutes only 15%.

- Patients with > 70% ST resolution (complete STR) associated with less frequent adverse events during hospital stay and less inpatient mortality.

- Patients with 30-70% ST resolution (partial STR) associated with mor frequent adverse events during hospital stay when compared to complete STR group, but less frequent adverse events when compared to No STR group.

- Patients with < 30% ST resolution (no STR group) were associated with more frequent adverse events and in hospital mortality.

- Among adverse events, left ventricular failure is most frequent adverse events seen in 33.3% cases, followed by arrhythmias 26.7% cases recurrent angina 18.3% cases and cardiogenic shock 8.3% cases.

- Inpatient mortality seen in 7 cases that is 11.7% cases. Most common causes of death are cardiogenic shock 71.4% cases followed by VT / VF 28.6% cases.

LIMITATIONS OF THE STUDY

- ❖ Sample size is small only 60.

- ❖ ST segment after acute myocardial infarction is dynamic and use of static measurement could have led to errors in labelling of patients as successful a failed reperfusion.

- ❖ In the present study, only short term outcome assessed in the form of in hospital adverse events and in hospital mortality.

- ❖ Study findings were not correlated with coronary angiography and nuclear imaging which were gold standard investigation for estimating coronary artery patency and myocardial perfusion respectively.

CONCLUSION

Patients who were thrombolyzed earlier had better ST segment resolution and better outcome than who were thrombolyzed later.

Patients with no resolution of ST segment 90 minutes following thrombolysis were associated with more frequent adverse events and increased mortality compared to partial and complete resolution group.

Percentage of resolution of ST segment following 90 minutes of thrombolysis as a diagnostic test helps in risk stratification of patients.

BIBLIOGRAPHY

1. Schroder K. Extent of ST segment deviation in single ECG lead 90 minutes after thrombolysis as a predictor of medium term mortality in acute MI. Lancet 2001; 358:14:79-86.

2. Farrer M. Change in ST segment elevation 60 min after thrombolytic initiation predicts clinical outcome accurately as later electrocardiographic changes. Heart 1997;78:461-71.

3. Anthon K. Prognostic clinical significance of ST segment potential determined by body surface mapping in patients with acute myocardial infarction. Circulation 1987;76(2):287.

4. Wikipedia. Coronary circulation. The free encyclopedia. En_wikipedia/org/wiki/ coronary_artery; 2008.

5. de Luna B. The heart walls and coronary circulation. Chapter I. 1st ed. Oxford,London: Blackwell Publishing; 2006. pp. 1-8.

6. van de Werf F, Ardissins, D, Betriu A, Cokkinos DV, Falk E. Management of acute myocardial infarction on patients presenting with ST segment elevation. European Heart Journal; 2003;24:28-66.

7. Antman EM, Braunwald E. ST segment elevation myocardial infarction. 18th ed. Chapter 239. In: Harrison's Principles of Internal Medicine, Fauci, Braunwald, Kasper, Hauser, Longon, Jameson, eds. 18th ed. New York: McGraw-Hill Companies; 2008. pp. 1532-44.

8. Blann AD. ABC of anti thrombotic therapy. An overview of thrombolytic therapy. BMJ 2002 Oct;325.

9. Braunwald E, Zipes DP, Libby P. A textbook of heart disease. 6th ed. Philadelphia: WB Saunders and Company; 2002.

10. ACC / AHA Guidelines for the Management of patients with ST elevation myocardial infarction – Executive summary: A report of the American College of Cardiology / American Heart Association Taskforce on gractice guidelines for management of patients with acute myocardial infarction.

11. Gruppo. Italiano per lo studio della streptokinase well infarction miocardico (GISSI-1, effectiveness of IV thrombolytic therapy in AMI). Lancet 1986; 397-401.

12. Grines CL. Optimal utilization of thrombolytic therapy for AMI concepts and controversies. J Am Coll Cardiol 1990;16:223-31.

13. Christiansen CL. Effectiveness of thrombolytic therapy for acute MI in elderly. Arch Intern Med 2002;161:5568-610.

14. Late assessment of thrombolytic efficiency study group. 6-24 hours after the onset of AMI. Lancet 1993;342:759-66.

15. EMERAS (Eotudio Multicentrio Estreptoquinase Republic de America del sur). Collaborating group. Randomized trial of late thrombolysis in AMI. Lancet 1993; 342;767-72.

16. William JL. Significance initial ST segment elevation and depression for the management of thrombolytic therapy is acute myocardial infarction. Circulation 1990;82:1147-58.

17. Hogg KJ. Electrocardiographic prediction of coronary artery patency after thrombolytic treatment in acute MI use of ST segment as a non-invasive marker. British Heart J 1988;60:275-80.

18. ISIS-3. A randomized comparison of streptokinase v/s rtPA and of aspirin and v/s aspirin along among 41, 299 patients. Lancet 1992;339:753-70.

19. Essen R. Myocardial infarction and thrombolytic ECG short term and long term results using precordial mappling. British Heart J 1985;54:6-10.

20. Brockemeirer J. Resolution of ST segment elevation in acute MI early prognostic significance after thrombolysis therapy results from COBALT trial. Herz 1999 Oct;24(6):440-7.

21. Chia BI, Yid JW. Usefulness of ST elevation II / III ratio and ST deviation in lead I for identifying the culprit artery in inferior wall acute myocardial infarction. Am J Cardiol 2000 Aug 1;86(3):341-3.

22. Ohsuzu F. Relation of segment wall motion to global left ventricular function in acute myocardial infarction. Am J Cardiol 1983;51:1275.

23. Goldberger AL. Myocardial ischemia and infarction. 7th ed. Chapter 8. In: Clinical electrocardiography. Philadelphia: Elsevier Publishers; 2007.

24. Samson WE, Scher A. Mechanism of ST segment alteration during acute myocardial injury. Circ Res 1966;780-7.

25. Pardee HEB. Electrocardiographic sign of coronary artery obstruction. Arch Int Med 1920;26:244.

26. Li RA, Leppo M, Ki TM, Seino S. Molecular basis of electrocardiographic ST segment elevation. Circ Res 2000;87:837-9.

27. Schroder R, Wegscheider K, Schroder K. Extent of early ST segment elevation resolution: a strong prediction of outcome in patients with acute myocardial infarction and a sensitive measure to compare thrombolytic regimen. A substudy of the International Joint Efficacy Comparison of Thrombolysis (INJECT) trail. J Am Coll Cardiol 1995;26:1657-64.

28. de Lemos JA, Antman EM, Giugliano RP. ST-segment resolution and infarct related artery patency and flow after thrombolytic. Thrombolysis in Mycardial Infarction (TIMI) 14 investigators. Am J Cardiol 2000;85(3):299-304.

29. Neuhaus KL. HIT-4 study was supported by Marburg BAG. Germany non- invasive detection of early infarct vessel patency by resolution of ST segment elevation in patients with thrombolysis for acute MI. Eur Heart J 2001;22:769-75.

30. Sohroder K, Wegscheider K, Zeymen U, Tebbe U, Schroder R, et al. Extent of ST segment deviation in a single electrocardiogram lead 90 min after thrombolysis as a predictor of medium-term mortality in acute myocardiol infarction. Lancet 2001;358:1479-86.

31. Van't Hof AW, Liem A, de Boer MJ, Zijlstra F. Clinical value of 12 lead electrocardiogram after successful reperfusion therapy for acute myocardial infarction. Zwolle myocardial infarction study group. Lancet

32. Matezky S, Novikov M, Gruberg L. The significance of persistent ST elevation versus early resolution of ST segment elevation after primary PTCA. J Am Coll Cardiol 1999;34(7):1932-8.

33. Somotsu Y, Nakamura M, Degawa T, Yamaguchi T. Prognostic value of slow resolution of ST segment elevation following successful direct percutaneous transluminal coronary angioplasty for recovery of left ventricular function. Am J Cardiol 1997;80(4):406-10.

34. Santoro GM, Antoniucci D, Valenti R. Rapid reduction of ST segment elevation after successful direct angioplasty in acute myocardial infarction. Am J Cardiol 1997;80(6):685-9.

35. Ito H, Tomooka T, Sakai N. Lack of myocardial perfusion immediately after successful thrombolysis. A predictor of poor recovery of left ventricular function in anterior myocardial infarction. Circulation 1992;85(5):1699-705.

36. Kondo M, Nakano A, Saito D, Shimono Y. Assessment of microvascular no-reflowphenomenon using technetium-99m macroaggregated albumin scintigraphy in patients with acute myocardial infarction. J Am Coll Cardiol 1998;32(4):898-903.

37. Schroder R, Zeymer U, Wegscheider K, Nuhans KL. Comparison of the predictive value of ST segment elevation resolution at 90 and 180 min after start of streptokinase in acute myocardial infarction. A substudy of the horudin for improvement of thrombolysis (HIT)4 study. Eur Heart J 1999;20(21):1563-71.

38. Shah A, Wagner GS, Granger CB. Prognostic implication of TIMI flow grade in the infarct related artery compared with continuous 12 lead ST segment resolution analysis. Renaming the gold standard for myocardial reperfusion assessment. J Am Coll Cardiol 2000;35(3):666-72.

39. French JK, Andrews JMB, Manda SOM, Steward RAH, McTigue JJC, et al. Early ST segment recovery infarct artery blood flow and long term outcome after acute myocardial infarction. American Heart Journal 2002 Feb;143(2):265-71.

40. Zeymer U, Schroder R, Tebbe U, Malhock GP, Wegscheider K, Neuhaus KL, et al. Non-invasive detection of early infarct vessel patency by resolution of ST segment elevation in patients with thrombolysis for acute myocardial infarction. European Heart Journal 2001;22:769-75.

41. Dong J, Ndsepepa G, Schmitt C, Mehilli J, Schmieder S, Schwaiger M, et al. Early resolution of ST segment elevation correlates with myocardial salvage. Assessed by TC-99m sestamibi scintigraphy in patients with acute myocardial infarction after mechanical or thrombolytic reperfusion therapy. Circulation 2002 Jun 3;105:2946-9.

42. Bhatia L, Clesham GJ, Turner. Clinical implications of ST segment non-resolution after thrombolysis for myocardial infarction. Jr Soc Med 2004;97:566-70.

43. Sezer M, Nisanci Y, Bumman, Yilmaz E, Olcay A, Erzengin F, Oozsaruhan, et al. New support for clarifying the relation between ST segment resolution and microvascular function: degree of ST segment resolution correlates with the pressure clerical collateral flow index. Heart 2004;90:146-50.

44. David AR, Harvey WD, Magnus OE, Galen WS, Mitchell KW, Paul AW, et al. Predicting outcome after thrombolysis in acute myocardial infarction according to ST segment resolution at 90 minutes. A substudy of Gusto III trial. The American Heart Journal 2002;144(1):81-8.

45. Robert C Schlant, Wayne R Alexander. Diagnosis and management of chronic ischemic heart disease. In: Robert C Schlant, Wayne R Alexander Editors. Hurst's The Heart

46. Sleignt P. Myocardial infarction. In: Weatherall DJ, Ledingham J.G.G., Warrell D.A. editors Oxford Textbook of Medicine, 3rd Edition. Oxford; Oxford Press: 1996. P. 2331-2348.

47. Louis S, Mickeever, Elaine L Enger. Pathophysiology of the acute coronary syndrome. In: Rogue Pifarre, Patrick J Scanlar Editors. Evidenced based management of the acute coronary syndrome. Philadelphia; Hanley & Beltus Inc.: 2001. P. 1-20.

48. Glenn L Laffel, Braunwald E. Thrombolytic therapy – A new strategy for the treatment of acute myocardial infarction (first of two part). New Engl J Med. 1984; 311(11): 710-717.

49. Tennant R, Wiggens CT. The effect of coronary occlusion on myocardial contraction. Am. J. Phisiol, 1935; 112: 351.

50. Gregory J Dehmer. Role of coronary angiography in the evaluation of patients with acute coronary syndromes. In: Roque Pifarre, Patrick J Scanlar Editors. Evidenced based management of the acute coronary syndrome. Philadelphia; Hanley & Beltus Inc.: 2001.

51. Ruegsgger P, Nydick I. Hutter RC et al. Fibrinolytic therapy (plasmin) of experimental coronary thrombi with alteration of the evolution of myocardial infarction. Circulation, 1959; 19: 7-13.

52. Favaloro RG, Ettler DV, Chean Vechai C et al. Acute coronary insufficiency (impending MI and myocardial ischemia):

53. Kordenat RK, Kedzi P.Experimental intracoronary thrombosis and selective in situ lysis by catheter technique. Am. J. Cardiol 1972; 30: 640-5.

54. Berg R Jr, Kendell RW, Duveisin GE et al. Acute MIL A surgical emergency. J. Thorac Cardiovasc Surg, 1975; 70: 432-439.

55. Chazer ET, Mateera LS, Mazaer AV et al. Intracoronary administration of fibrinolysis in acute myocardial infarction. Ter Arkh 1976; 48: 8

56. Reinmer KA, Lower TE, Rasmussen MM, Jennings RB. The wavefront phenomenon of ischemic cell death-1. Myocardial infarct size versus duration of coronary occlusion in dogs. Circulation 1977; 56: 786-94.

57. Rentrop KP, Blanke H, Karsch KR, Kreuzer H. Initial experience with

transluminal recanalization of the recently occluded infarct related coronary artery in acute myocardial infarction: Comparison with conventionally treated patients. Clin Cardiol 1979; 2: 92-105.

58. Dewood MA, Spores J, Motski R, Mouser LT, Burroughs R, Golden MS, Lang HT. Prevalence of total coronary occlusion during the early hours of transmural myocardial infarction. N Engl Med, 1980;303: 897-902.

59. Kloner RA, Ellis SG, Lange R, Braunwald E. Studies of experimental coronary artery reperfusion: Effects on infarct size, myocardial function, biochemistry, ultrastructure and microvascular drugs Circulation. 1988; 68(Suppl-I): I-8-I-15.

60. Anderson TL, Marshall HW, Bray BE et al. A randomized trial of intracoronary streptokinase in the treatment of acute myocardial infarction. N Engl J Med, 1983; 308: 1312-8.

61. Kennedy JW, Ritchie JL, Darisk B. Fritz J, Western Washington randomized trial of intracoronary streptokinase in acute myocardial infarction. N Engl. J. Med, 1983; 309: 1477-1482.

62. Simoons M, Van Den Brand M, De Zwaan C, Verhengt FWA, Remme WJ, Serruys PW, Bar F, Res J, Kranss XH, Vermcer F, Lubsen J. Improved survival after early thrombolysis in acute myocardial infarction: A randomized trial of the interuniversity cardiology Institute in the Netherlands. Lancet 1985; 2: 578-582.

63. Schroder R, Biamino G, Enz-Rudiger VL, Thomas Linceres, Thomas Bruggiemena, Jorg Heitz. Intravenous short-term infusion of streptokinase in acute myocardial infarction. Circulation 1983; 67: 536-48.

64. Yusuf S, Collins R, Peto R, Furberg C, Stampfor MJ, Goldberg SZ, Hennekens CH. Intravenous and intracoronary fibrinolytic therapy in acute myocardial infarction: Overview of results on mortality, reinfarction and side effects from 33 randomized controlled trials. Eur Heart J. 1985 Jul; 6(7): 556-

65. The ISAM Study Group. A prospective trial of intravenous streptokinase in acute myocardial infarction (ISAM). Mortality, Morbidity and Infarct Size at 21 days. N Engl. J. Med 1986; 314: 1465-1471.

66. Gruppo Italiano Per lo Studio della Streptochinasi nell' Infarto miocardico (GISSI). Effectiveness of intravenous thrombolytic treatment in acute myocardial infarction. Lancet 1986;1: 397-402.

67. ISIS-2 (Second International Study of Infarct Survival) Collaborative Group. Randomized trial of intravenous streptokinase, Oral aspirin, both or neither among 17,187 cases of suspected acute myocardial infarction: ISIS-2, Lancet 1988; 2: 349-360.

68. ISIS-3 (Third International Study of Infarct Survival) Collaborative Group ISIS-3. A randomized comparison of streptokinase versus tissue plasminogen activator versus aspirin alone among 41,299 cases of suspected acute myocardial infarction. Lancet 1992; 339: 753-770.

69. Emeras (Estudio Multicentrico Estreptoquinrsa Reupblic de Amerile de Sur) Collaborative Group. Randomized trial of late thrombolysis in patients with suspected acute myocardial infarction. Lancet 1993; 342: 767-772.

70. Late Study group. Late assessment of thrombolytic efficacy (LATE) study with alteplase 6-12 hours after onset of acute myocardial infarction. Lancet

71. Firbinolytic Therapy Trialists (FTT) Collaborative Group 1994. Indications for fibrinolytic therapy in suspected acute myocardial infarction: Collaborative overview of early mortality and major morbidity results from all randomized trials of over 1000 patients. Lancet 1994; 343: 311-322.

72. Eric J topol, Robert M Califf MD, Michel Vanderwal HD. A randomized trial of late reperfusion therapy for acute myocardial infarction. Circulation, 1992; 185: 6.

73. Igawo A, Fujita M, Yamanishi K, Inoko M, Miwa K. Comparative effects of early and late reperfusion of the infarct related coronary artery and collateral circulation, which develops after infarction on left ventricular size and function. Jpn Circ J. 1993 Nov; 57(11): 1055-

74. Leoncin M, Marcuui G, Santoro GM, Sciagra R, Bini L, Bisi et al. Late thrombolysis in acute myocardial infarct, Demonstration of myocardial tissue salvage by the assessment of pre-post thrombolytic perfusion and left ventricular function. G Ital Cardiol 1994 Nov; 24(11): 1359-70.

75. Romero MH, Espinosa Vazqnez A, Ramos Corrales MH, Solorio S, LepeMantoya L, Badu E, Ocampo S, Carrillo HM.

PROFORMA

1. PRELIMINARY DATA:

Name : Religion :
Age : Address :
Sex :
Income : I.P. No :
Occupation : D.O.A :

2. PRESENTING COMPLAINTS:

- ☐ Chest pain
- ☐ Syncopal attacks
- ☐ Dyspnoea
- ☐ Shock
- ☐ Palpitation .
- ☐ Other symptoms
- ☐ Giddiness
- ☐ Sweating, Vomiting, Nausea, Haemoptysis,

3. HISTORY OF PRESENTING ILLNESS:

Chest Pain

Site Precordium ☐ retrosternal ☐ epigastric ☐ elsewhere ☐

Radiation ☐

- sudden Onset ☐ Aggravating/ Precipitating factor
- Duration - Relieving factors
- Character - Associated symptoms

Dyspnoea

- Mode of onset - Exertional or at rest
- Grade - H/o P.N.D.
- H/o Orthopnoea - H/o Haemoptysis
- Associated Symptoms

Palpitation

– Mode of onset - Exertional or at rest
– Consciousness of irregularity
– H/o taking any drugs

4. PAST HISTORY

- H/o anginal attacks - H/o R.H.D
- H/o suggestive of M.I - H/o exposure to V.D
- H/o Hypertension ☐ Diabetes ☐ Renal disease ☐ CAHD ☐

5. PERSONAL HISTORY:

- Diet - Vegetarian or Non-vegetarian
- Habits - Smoking, ☐ Alcohol ☐ Tobacco ☐

6. FAMILY HISTORY:

- Married or single - H/o Diabetes mellitus
- Number of children - H/o Hypertension
- H/o CAHD in the family H/o early and / or sudden death

7. SOCIO-ECONOMICAL AND OCCUPATIONAL HISTORY

- Occupation - Executive / Clerical / Labour
- Home environment and surroundings

8. TREATMENT HISTORY:

9. GENERAL PHYSICAL EXAMINATION:

- General Condition - Good / Fair / Bad
- Built - Well / Moderate / Poor
- Nutrition - Well / Moderate / Poor
- Presence of sweating
- Pallor, Cyanosis, Jaundice, Clubbing, Oedema. Lymphadenopathy
- Xanthomas
- Any external congenital anomalies,

<u>Vital signs</u>

Temperature

Pulse - /min Rhythm Volume Character Condition of the Vessel wall Radio femoral / Radio radial delay

Respiratory rate

Blood Pressure Right UL Left UL supine posture

10. EXAMINATION OF Cardio-Vascular System

J.V.P - Raised / not raised

Precordial Examination

Inspection: Shape of the chest / any precordial bulging / Apical impulse

Any Precordial pulsation / Parsternal heave / Neck Pulsation

Palpation: Apical impulse – Position / Character

Parasternal heave / thrills / palpable sound

Percussion: Cardiac borders / any other findings

Auscultation:

Heart sounds S1, s2,

Added sounds s3, s4,

Pericardial rub

Murmur

a. Mitral area

b. Tricuspid area

c. Aortic area

d. Pulmonary area

11. EXAMINATION OF R.S.

Pulmonary Edema only Bases Extensive

12. PER ABDOMEN:

13. EXAMINATION OF C.N.S:

14. INVESTIGATIONS:

Blood – Hb% TC D.C. E.S.R.

Fasting lipid profile FBS PPBS

BI. Urea. S. Creatinine

Cardiac enzymes – Trop. T

Urine – Albumin - Sugar - Microscopy

Electrocardiogram

Before Thrombolysis

Rate Q.R.S. complex & duration Rhythm Q.T. Interval Axis

S.T. Segment

- P. Wave - T. Wave - P.R. Interval - Any other significant findings

Sum of ST segment Elevation

ECG 90 min after start of thrombolysis

Rate Q.R.S. complex & duration Rhythm Q.T. Interval Axis

S.T. Segment

- P. Wave - T. Wave - P.R. Interval - Any other significant findings

Sum of ST segment Elevation

Percentage of ST segment resolution after thrombolysis:

No STR < 30% ☐ Partial STR 30-70% ☐ Complete STR More than 70% ☐

Time interval:

Time of Onset of Chest Pain:

Time of Start of Thrombolysis:

Chest pain to Thrombolysis time interval CPTT:

15. DIAGNOSIS:

16. COARSE OF ILLNESS DURING HOSPITAL STAY

- No adverse event ☐ Adverse event ☐ Death ☐

17. TYPE OF ADVERSE EVENT

Left ventricular failure / Recurrent angina / Cardiogenic shock / Arrhythmias / Others

STATISTICAL METHODS APPLIED

Descriptives

The Descriptives procedure displays univariate summary statistics for several variables in a single table and calculates standardized values (z scores). Variables can be ordered by the size of their means (in ascending or descending order), alphabetically, or by the order in which you select the variables.

Frequencies

The Frequencies procedure provides statistics and graphical displays that are useful for describing many types of variables. The Frequencies procedure is a good place to start looking at your data.

Cross tabs procedure

The Crosstabs procedure forms two-way and multiway tables and provides a variety of tests and measures of association for two-way tables. The structure of the table and whether categories are ordered determine what test or measure to use.

Independent-Samples T Test

The Independent-Samples T Test procedure compares means for two groups of cases. Ideally, for this test, the subjects should be randomly assigned to two groups, so that any difference in response is due to the treatment (or lack of treatment) and not to other factors.

SPSS for windows Version-16 (2007) was employed for statistical analysis.

KEY TO MASTER CHART

Symptoms

CP	↱	Chest pain
BR	↱	Breathlessness
SY	↱	Syncope
Pal	↱	Palpitation
SW	↱	Sweating
P	↱	Present
A	↱	Absent

Risk factors

HTN	↱	Systemic hypertension
DM	↱	Type 2 Diabetes mellitus
SM	↱	Smoking
PA	↱	Past History of Angina
FH	↱	Family history of IHD

Pulse

R	↱	Regular
I	↱	Irregular
JVP	↱	Jugular venous pressure
N	↱	Normal
I	↱	Increased

Heart sounds

INT	⇗	Intensity
AS	⇗	Additional sounds
M	⇗	Muffled
N	⇗	Normal
KC	⇗	Killip class

Respiratory system

N	⇗	Normal vesicular breath sounds
BC	⇗	Basal crepitation
R	⇗	Ronchi
PA	⇗	Per abdomen
N	⇗	Norm
HM	⇗	Hepatomegaly
BMI	⇗	Body mass index

Time lag from chest paint o initiation of thrombolysis

STR	⇗	ST segment resolution
N	⇗	No resolution
P	⇗	Partial resolution
G	⇗	Good resolution

Time lag from onset of symptoms to adverse events

Adverse event

LVF	⇗	Left ventricular failure
CS	⇗	Cardiogenic shock
RA	⇗	Recurrent angina
AR	⇗	Arrhythmia

Outcome

NAE	⇗	No adverse event
AE	⇗	Adverse event
D	⇗	Death

Master Chart

Sl.No.	Patient name	AGE	Sex	IP No.	Symptoms						Risk factors						Pulse		BP	RESP RATE	JVP	Heart sounds		KC	Other systems		BMI	Diagnosis		CPTT	ST segment resolution at 90 min			Time lag between onset of symptoms to adverse event		Adverse events					Outcome			CAUSE OF DEATH
					CP	BR	SY	PAL	SW	OTHERS	HTN	DM	SMS	PASTHS	FH	OTHERS	RATE	RHYTHM				INT	AS		RS	P/A		AWMI	IWMI		<30%	30-70%	>70%	<48hr	48hr-1w	LVF	CS	RA	AR	OTHERSS	NAE	AE	D	
1	Suresh	45	M	149052	P	A	A	A	P	-	+	+	+	-	-	-	100	R	140/90	26	N	M	-	II	BC	N	23.2	+	-	6h	-	+	-	+	-	+	-	-	-	-	-	+	-	-
2	Krishnasamy	55	M	148927	P	A	P	P	P	-	-	-	+	-	-	-	90	I	100/70	24	N	M	-	I	N	N	20.4	-	+	4h	-	-	+	+	-	-	-	-	+	-	-	+	-	-
3	Nagammal	63	F	148722	P	A	A	A	P	-	+	-	-	-	-	-	100	R	110/70	22	N	N	-	I	N	N	18.4	-	+	3h	-	-	+	-	-	-	-	-	-	+	-	-	-
4	Balamurugan	45	M	148831	P	A	A	A	P	-	+	+	+	+	-	-	104	R	130/80	22	N	M	-	I	N	N	24.6	-	+	5h	-	+	-	-	-	-	-	-	-	+	-	-	-
5	Sivasami	50	M	148485	P	A	A	A	P	-	+	-	+	-	-	-	50	R	130/80	18	N	M	-	I	N	N	23.2	-	+	6h	-	+	-	+	-	-	-	-	+	-	-	+	-	-
6	Nagarajan	35	M	148669	P	P	A	A	P	-	-	-	+	-	+	-	100	R	100/60	32	I	M	S3	III	BC	N	22.4	+	-	5h20m	-	+	-	+	-	+	-	-	+	-	-	+	-	-
7	Thambiah	55	M	148642	P	A	A	A	P	-	-	-	+	+	-	-	75	R	140/90	16	N	M	-	I	N	N	23.4	+	-	2h	-	-	+	-	-	-	-	-	-	+	-	-	-
8	Kannan	45	M	148509	P	A	A	A	P	-	-	-	+	-	-	-	75	R	130/80	16	N	M	-	I	N	N	22.6	-	+	2h20m	-	-	+	+	-	-	-	-	+	-	-	+	-	-
9	Nagamma	55	F	148255	P	A	A	A	A	-	+	+	-	-	-	-	64	R	150/90	20	N	M	-	I	N	N	23.2	+	-	7h	+	-	-	-	+	-	+	-	-	-	-	-	+	CS
10	Mahendran	50	M	148864	P	A	A	A	P	-	-	-	+	+	-	-	64	R	140/80	18	N	N	-	I	N	N	16.4	+	-	6h20m	-	+	-	+	-	+	-	-	-	-	-	+	-	-
11	Pulavendran	60	M	3400	P	P	A	A	P	-	+	-	+	-	-	-	75	R	130/80	28	N	N	-	II	BC	N	20.4	+	-	4h40m	-	+	-	+	-	+	-	-	+	+	-	+	-	-
12	Kaveri	62	M	8611	P	A	A	A	P	-	-	-	+	-	-	-	72	R	120/70	22	N	M	-	I	N	N	21.2	-	+	3h	-	-	+	-	-	-	-	-	-	+	-	-	-
13	Gopal	50	M	3425	P	A	A	A	P	-	+	+	+	-	-	-	80	R	130/80	28	N	M	-	II	BC	N	24.2	+	-	6h	-	+	-	+	-	+	-	-	-	-	-	+	-	-
14	Saminathan	45	M	3365	P	A	A	A	P	-	-	+	+	-	-	-	110	R	140/90	30	I	M	S3	II	BC+R	N	23.4	+	-	6h20m	+	-	-	+	-	+	-	-	+	-	-	+	-	-
15	Jhansirani	45	F	2824	P	P	A	A	P	-	+	+	-	+	+	-	64	I	130/90	26	N	M	-	II	+BC	N	27.2	-	+	5h40m	-	+	-	+	-	+	-	-	+	+	-	+	-	-
16	Siddar	60	M	842	P	A	A	A	P	-	-	-	+	-	-	-	64	R	130/80	18	N	N	-	I	N	N	20.2	-	+	3h	-	-	+	-	-	-	-	-	-	+	-	-	-
17	Pappamma	58	F	1200	P	A	A	A	P	-	-	-	-	-	-	-	64	R	130/70	18	N	N	-	I	N	N	21.2	-	+	2h40m	-	-	+	-	-	-	-	-	-	+	-	-	-
18	Md Yousuf	40	M	671	P	A	P	A	P	-	+	-	+	-	-	-	72	R	140/90	28	N	M	-	I	R	N	22.4	-	+	6h	-	+	-	+	-	-	-	+	-	-	+	-	-
19	Girija	55	F	149223	P	P	A	P	P	-	-	+	-	+	+	-	120	R	170/100	34	I	M	S3	II	BC+R	N	26.4	+	-	6h40m	+	-	-	+	-	+	+	+	-	-	-	-	+	CS
20	arunachalam	50	M	149019	P	A	A	A	A	-	-	+	+	-	-	-	70	R	130/90	18	N	M	-	I	N	N	24.2	-	+	7h	+	-	-	+	-	-	+	+	-	-	+	-	-	-
21	Subbama	58	F	7211	P	A	A	A	P	-	-	-	-	-	-	-	42	R	80/60	18	N	M	-	I	N	N	22.1	-	+	2h20m	-	-	+	-	-	-	-	-	-	+	-	-	-
22	Madasamy	72	M	7079	P	A	A	A	P	-	+	-	+	-	-	-	84	R	150/90	22	N	M	-	I	N	N	23.4	+	-	3h	-	-	+	-	-	-	-	-	-	+	-	-	-
23	Nallamuthu	32	M	6584	P	P	A	A	P	-	+	-	+	+	-	-	120	R	180/90	36	I	M	S3	III	BC+R	N	20.2	+	-	6h	+	-	-	+	-	+	-	-	+	-	-	-	+	VT
24	Rajathi	60	F	5588	A	A	P	A	A	-	-	-	-	-	-	-	40	R	80/50	18	I	M	-	I	N	N	23.2	-	+	4h	-	+	-	-	+	-	-	-	-	-	-	+	-	-
25	Shivraj	57	M	5381	P	A	A	A	P	-	-	-	+	-	-	-	90	R	130/90	18	N	M	-	I	N	N	22.6	+	-	7h	-	+	-	-	+	-	-	+	-	-	+	-	-	-
26	M.Gouse	64	M	5322	P	P	A	A	P	-	+	+	+	+	+	-	120	R	160/100	32	I	M	-	II	BC	N	27.2	+	-	3h	-	-	+	+	-	+	-	-	-	-	-	+	-	-
27	Prakash	44	M	5216	P	A	A	A	P	-	-	-	+	-	-	-	90	R	140/80	18	N	M	-	I	N	N	24.2	+	-	2h	-	-	+	-	-	-	-	-	-	+	-	-	-
28	M Shariff	46	M	4863	P	A	A	A	P	-	+	-	+	-	-	-	84	R	130/90	18	N	M	-	I	N	N	26.2	+	-	7h	-	+	-	-	+	-	-	+	-	-	+	-	-
29	pitchai	60	M	4378	A	P	A	A	P	-	+	+	-	-	-	-	100	R	160/100	34	N	M	S3	III	BC	N	24.2	+	-	5h	-	-	+	+	+	-	-	-	+	-	-	-	+	VT
30	ayyappan	51	M	4150	P	A	A	A	A	-	-	+	+	-	-	-	70	R	120/70	18	N	M	-	I	N	N	23.2	+	-	2h20m	-	-	+	-	-	-	-	-	-	+	-	-	-	-

Master Chart

Sl.No.	Patient name	AGE	Sex	IP No.	Symptoms						Risk factors							Pulse		BP	RESP RATE	JVP	Heart sounds		KC	Other systems		BMI	Diagnosis		CPTT	ST segment resolution at 90 min			Time lag between onset of symptoms to adverse event		Adverse events					Outcome			CAUSE OF DEATH
					CP	BR	SY	PAL	SW	OTHERS	HTN	DM	SM	PASTHS	FH	OTHERS		RATE	RHYTHM				INT	AS		RS	P/A		AWMI	IWMI		<30%	30-70%	>70%	<48hr	48hr-1w	LVF	CS	RA	AR	OTHERSS	NAE	AE	D	
31	Nagarajan	48	M	10397	P	A	A	A	P	-	-	-	+	-	-	-		60	R	130/80	16	N	M	-	I	N	N	21.4	-	+	2h40m	-	+	-	-	-	-	-	-	-	+	-	-	-
32	Vishwanathan	45	M	9791	P	A	P	A	P	-	-	-	-	-	-	-		64	R	120/70	16	N	N	-	I	N	N	24.2	-	+	7h	-	+	-	-	-	-	-	-	-	+	-	-	-
33	Ramasamy	54	M	9782	P	A	A	A	P	-	+	+	-	+	-	-		76	R	150/90	18	N	M	-	I	N	N	25.2	+	-	4h	-	+	-	-	+	-	-	+	+	-	-	+	-	-
34	M.Basha	48	M	9006	P	A	A	A	P	-	+	-	+	-	-	-		84	R	160/100	28	N	M	-	II	BC	N	20.2	+	-	3h	-	-	+	+	-	-	-	-	-	-	-	+	-	-	-
35	kannappan	50	M	8445	P	P	A	A	P	-	+	+	+	-	-	-		100	R	180/110	34	I	M	-	III	BC	HM	24.2	+	-	2h40m	+	-	-	+	-	-	-	-	-	-	-	+	-	-	-
36	Marimuthu	40	M	8677	P	A	A	A	P	-	-	-	+	-	-	-		66	R	110/70	18	N	N	-	I	N	N	20.2	-	+	2h	-	-	+	-	-	-	-	-	-	-	+	-	-	-
37	Nagendran	50	M	8025	P	A	P	A	P	-	+	-	+	-	-	-		88	R	134/160	22	N	N	-	I	N	N	23.2	+	-	4h	-	+	-	-	-	-	-	-	-	-	+	-	-	-
38	Mariamma	40	M	7325	P	P	A	A	P	-	-	-	-	-	-	-		110	R	160/90	29	N	M	-	II	BC	N	24.4	+	-	3h	-	+	-	+	-	-	-	-	-	-	+	-	-	-
39	Purushathaman	38	M	7319	P	A	A	A	P	-	-	-	+	-	-	-		88	R	100/70	18	N	N	-	I	N	N	23.2	-	+	2h	-	-	+	-	-	-	-	-	-	+	-	-	-
40	Babu	40	M	7470	P	A	A	A	P	-	+	-	+	-	-	-		94	R	140/90	32	N	M	-	II	BC	N	26.2	+	-	4h40m	-	+	-	+	-	-	-	+	-	-	+	-	-	-
41	Rathnam	55	F	14527	A	P	A	A	P	-	-	+	-	+	+	-		104	R	180/100	36	I	M	-	III	BC	N	24.6	+	-	3h40m	-	+	-	+	+	+	-	+	+	-	-	+	-	-	-
42	shanmugam	47	M	14292	P	A	A	A	P	-	+	+	+	-	-	-		88	R	150/90	20	N	N	-	I	N	N	24.2	+	-	2h40m	-	-	+	-	-	-	-	-	-	+	-	-	-
43	Siddhanadha	60	M	13335	P	A	A	A	A	-	-	-	+	-	-	-		62	R	100/70	18	N	N	-	I	N	N	20.4	-	+	2h20m	-	-	+	+	-	-	-	+	-	-	+	-	-	-
44	shiek	45	M	13076	P	P	A	A	P	-	+	+	+	-	-	-		104	R	180/90	32	I	M	S3	III	BC	HM	26.4	+	-	2h	+	-	-	+	-	-	-	+	+	+	-	+	-	-	-
45	Nallamma	44	F	12947	P	A	A	A	P	-	+	+	-	-	-	-		56	R	100/60	18	N	N	-	I	N	N	26.2	-	+	4h20m	-	+	-	+	-	-	-	-	-	-	+	-	-	-
46	Ravi	30	M	11653	P	A	A	A	P	-	-	-	+	-	-	-		94	R	130/70	29	N	M	-	II	BC	N	21.2	+	-	2h20m	-	-	+	-	-	-	-	-	-	-	+	-	-	-
47	Madasamy	56	M	12040	P	A	A	A	P	-	+	-	+	-	-	-		88	R	140/70	18	N	N	-	I	N	N	23.2	+	-	3h	-	-	+	-	-	-	-	-	-	-	+	-	-	-
48	Rethinam	55	M	11259	P	P	A	P	P	-	+	+	+	+	-	-		120	R	100/70	38	I	M	-	III	BC+R	N	20.2	+	-	5h20m	+	-	-	+	-	+	+	-	-	-	-	-	+	CS
49	Thangavel	35	M	10499	P	A	A	A	P	-	-	-	+	-	-	-		64	R	100/70	18	N	N	-	I	N	N	24.2	-	+	2h40m	-	-	+	-	-	-	-	-	-	-	+	-	-	-
50	Balakumar	33	M	10449	P	A	A	A	A	-	-	+	+	-	-	-		88	R	120/80	22	N	N	-	I	N	N	23.4	+	-	5h	-	+	-	-	+	-	-	-	-	-	+	-	-	-
51	Kunjammal	65	F	20101	P	P	A	A	P	-	-	-	-	-	-	-		62	R	100/70	18	N	N	-	I	N	N	20.2	-	+	5h20m	-	+	-	-	-	-	-	-	-	-	+	-	-	-
52	Anbalagan	70	M	20797	P	P	A	A	P	-	+	+	+	-	-	-		100	R	180/100	32	I	M	S3	III	BC	HM	26.2	+	-	3h	+	-	-	+	-	+	+	-	-	-	-	-	+	CS
53	Manikandan	55	M	20155	P	A	A	A	P	-	-	-	+	-	-	-		68	R	100/70	18	N	N	-	I	N	N	22.4	-	+	3h	-	-	+	-	-	-	-	-	-	-	+	-	-	-
54	Nagamma	60	F	17671	P	A	A	A	P	-	+	-	-	-	-	-		92	R	130/90	18	N	N	-	I	N	N	23.2	+	-	6h	-	-	+	-	-	-	-	-	-	-	+	-	-	-
55	Harish	35	M	18558	P	A	P	A	P	-	+	+	+	-	-	-		60	R	90/60	18	I	M	-	I	N	N	24.1	-	+	5h	-	+	-	+	-	-	-	-	-	-	-	+	-	-	+
56	Balaguru	48	M	18236	P	A	A	A	P	-	+	-	+	-	-	-		84	R	120/80	20	N	N	-	I	N	N	20.2	+	-	4h20m	-	+	-	+	-	-	-	-	+	-	-	+	-	-	-
57	Sammandham	50	M	16903	P	P	A	A	P	-	+	-	+	-	-	-		110	R	170/100	32	N	M	-	II	BC	N	24.3	+	-	3h	-	-	+	+	-	-	-	-	-	-	-	+	-	-	-
58	Anwardeen	60	M	15651	P	A	A	A	P	-	-	-	+	-	-	-		74	R	140/90	18	N	N	-	I	N	N	23.2	+	-	2h20m	-	-	+	-	-	-	-	-	-	-	+	-	-	-
59	Nagesh	64	M	14582	P	A	A	A	A	-	-	-	+	-	-	-		64	R	100/70	20	N	N	-	I	N	N	21.2	-	+	6h	-	+	-	-	-	-	-	-	-	-	+	-	-	-
60	Zenath ammal	57	F	14506	P	A	A	A	A	-	-	-	+	-	-	-		72	R	100/60	20	N	N	-	I	N	N	20.6	-	+	4h20m	-	+	-	-	-	-	-	-	-	-	+	-	-	-